THE MODEL ENGINEER

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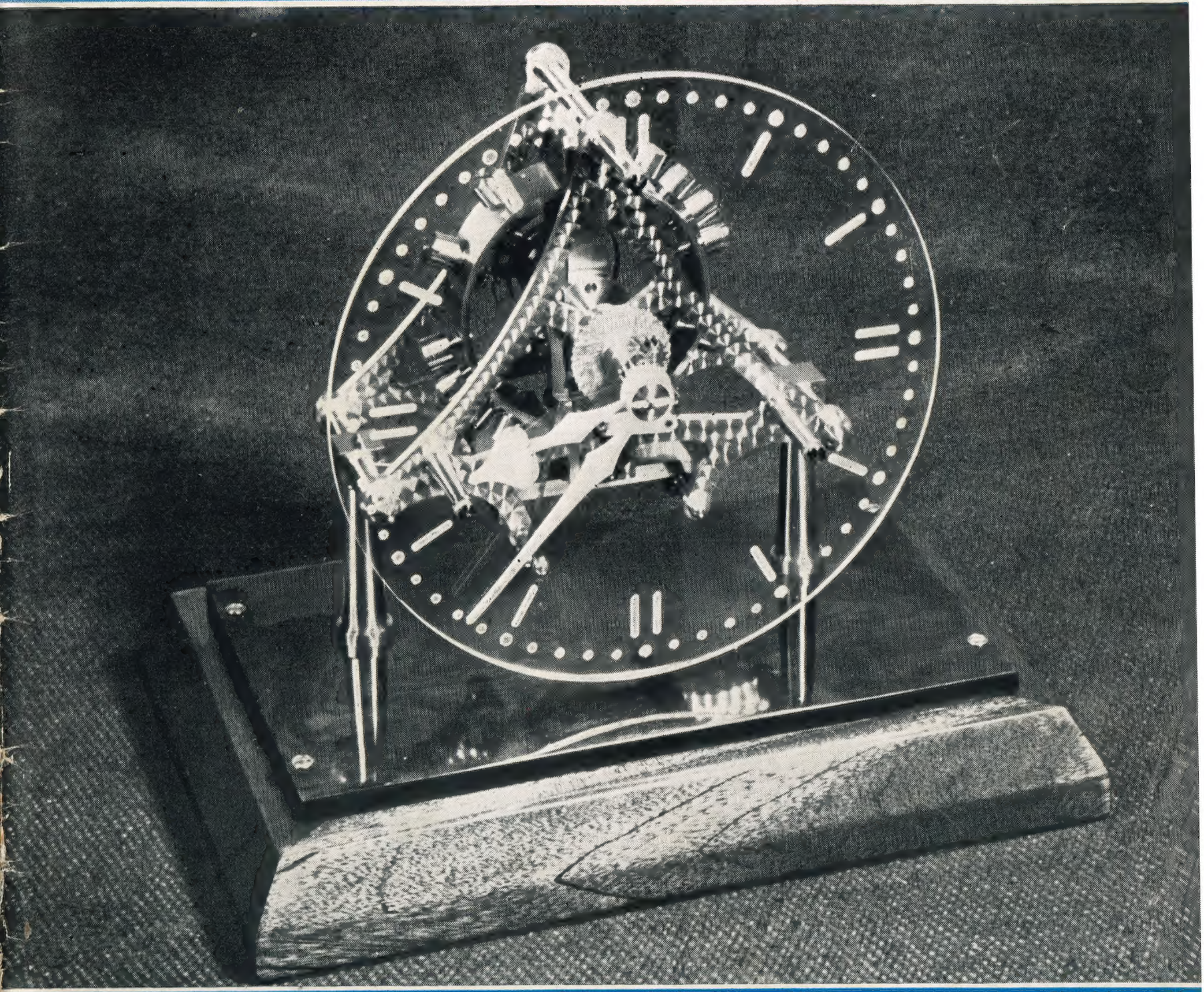

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- AN ADJUSTABLE OFF-SET TAILSTOCK CENTRE
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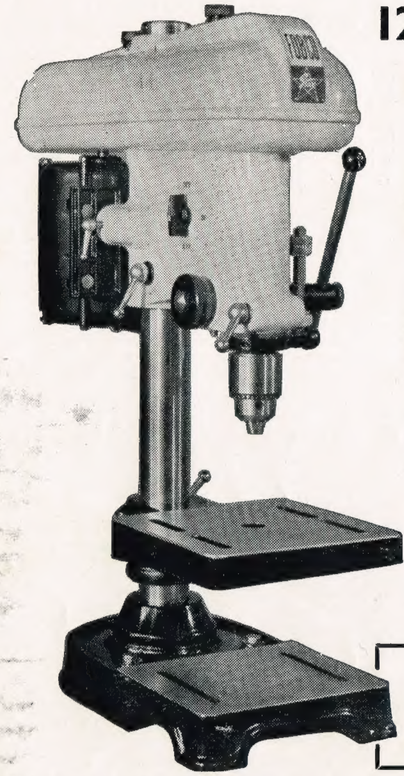

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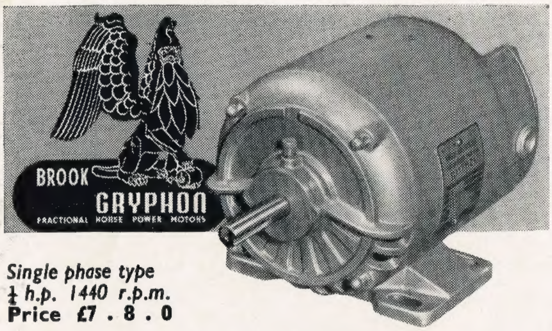

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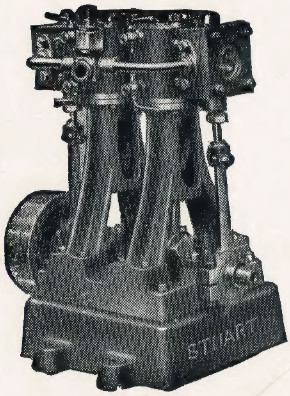

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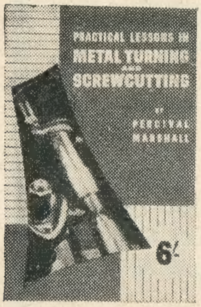

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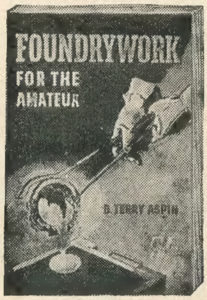

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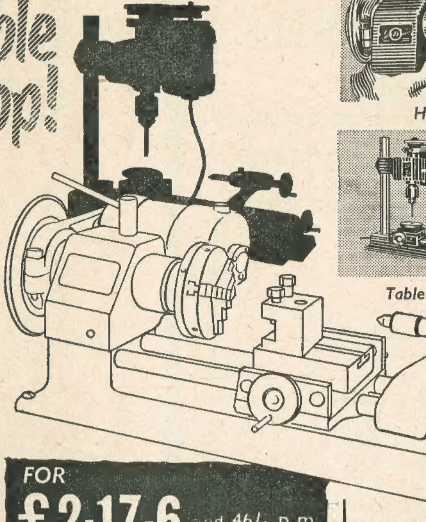

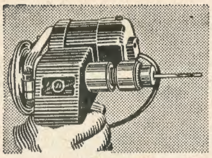
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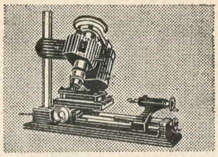
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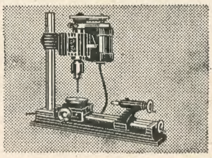
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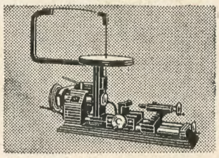
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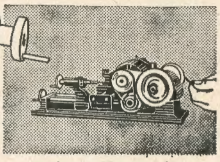
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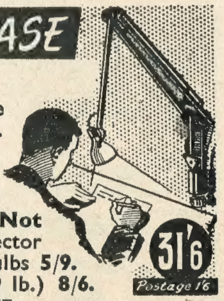

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THE MODEL ENGINEER

ESTABLISHED 1898

SMOKE RINGS

Volume 112 No. 2811

APRIL 7th 1955

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CONTENTS

OUR COVER PICTURE

Several interesting designs for battery-driven electric clocks have appeared in "The Model Engineer" at various times in the past, and one of the most ingenious was the "Eureka" balance-wheel clock described during February and March, 1949. A number of these clocks, with or without detail modifications, have been constructed by readers, and the one illustrated was the work of Mr. A. E. Bowyer-Lowe, of Letchworth. It differs from the original design in having an improved form of dial motion work employing epicyclic gearing, and also has a Perspex dial which renders visible all the working parts.

Workshop Power Plants

A RECENT letter from a reader who has no electric supply available for driving workshop equipment raises the much-discussed question of constructing an engine to run on gas or liquid fuel for this purpose, and asks whether a suitable design could be published in THE MODEL ENGINEER. In the past, a good deal of attention has been devoted to this matter by contributors, and some of the engine designs which were published many years ago would be just as applicable at the present day; but in recent years we have had several requests from readers for workshop engine designs in keeping with the most up-to-date practice. Unfortunately, the views of these readers as to the type of engine most suitable for their purpose vary widely. The open type horizontal engine, which held the field for stationary work for many years, is the most interesting type from the mechanical aspect, and is well suited to amateur construction, but the amount of space it occupies, and the individual attention it requires in respect of lubrication, etc., have made it unpopular for practical work in the modern workshop. Many of the most successful modern engines are relatively uninteresting, all the working parts being totally enclosed; and water-cooling has become almost obsolete for small-power engines. We should be pleased to undertake the necessary research work to produce a suitable design, if we could be convinced that there was a general demand for such an engine, and some agreement as to the best type. Readers who have definite views on this subject are invited to submit them with a view to deciding whether or not the matter merits further investigation.

G.G.L.S. First Exhibition

THE GOLDEN Gate Live Steamers of Northern California wish to extend a hearty welcome to brother model engineers, their friends and visitors to the first exhibition. The show is to be held in the Civic Auditorium, Oakland, May 13th, 14th and 15th, and will feature locomotives, power and sail boats and aircraft. There will also be display stands of working models; an indoor passenger-carrying track in three gauges, and a section set aside for moving pictures.

To help in publicising the event, the American Broadcasting Co. were kind enough to put it on the air (television) with a demonstration by the president Mr. William Brower of his "Mastodon" locomotive, an old-time wood-burner operating on a portion of the indoor track. One stand has been set aside for "Model Engineer" publications.

An S.P.C.L. ?

IN AN interesting letter from Hope-Johnstone Ltd., of Hamilton, New Zealand, we learn that one of the staff has completed *Tich*, the performance of which is amazing; so the same gentleman has begun the construction of another one, but for 7¼-in. gauge !

At the opening of the 550-ft. track of the Wanganui Model and Experimental Engineers, last November, this same enthusiast was informed that he would be "charged with cruelty to small locomotives," much to the delight of his colleagues.

Farewell Voyage

IT IS with deep regret that we record the death of Mr. E. W. Vanner, one of the best-known and best-loved personalities in the model power boat world. Ever since the pioneer days of this fraternity, his boats, both steam and petrol-driven, have plied consistently on ponds and lakes all over the country, and even on the Continent. He was a member of the Victoria Model Steamboat Club for upwards of forty years, and of the Kent Model Engineering Society since its inception; in recent years, he was elected President of the Model Power Boat Association and rarely missed either its regattas or council meetings. Always willing to help or advise in a good cause, his passing will be a serious loss to model engineering, but some of the boats which he has built will continue to run for many years, and will serve as a memorial to his life's work. We hope to publish further details of Mr. Vanner's career in a later issue.

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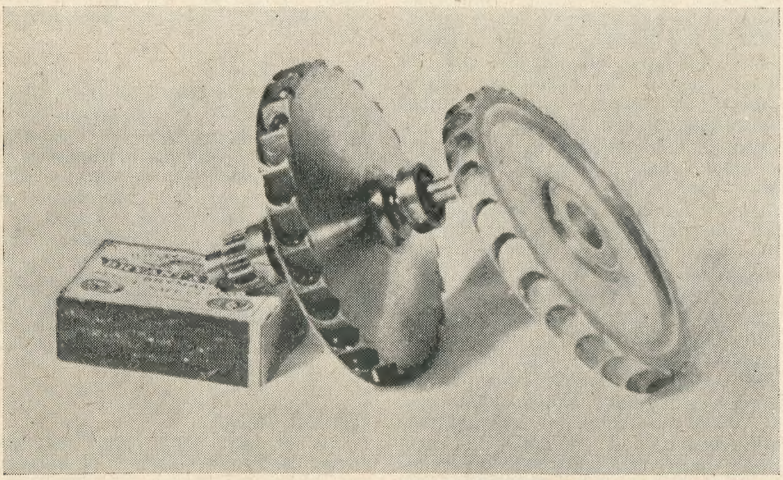
Experiments with Flash Steam

By J. A. Bamford

READERS may remember my previous somewhat abortive attempts to make a really powerful steam turbine. I had failed in my original idea of producing a hydroplane powered by a turbine, but could never quite convince myself that the small turbine could not be made to do the job; the result is, that, whenever I get an inspiration, I come up for some more punishment. Towards the end of the 1953 regatta season, I had got fed up with seeing my piston engine steamer sinking, and thought that the lighter turbine might profit from the boiler, which was then capable of evaporating about 1¾ lb. of water per minute. According to my original estimation of 1 b.h.p. per lb. of steam per minute, I should have nearly 2 b.h.p., and this should be enough to push an "A" class steamer along at about 30 m.p.h., which would be quite good enough for a start. I therefore installed the original turbine in the tinplate hull, and used the water and fuel pumps from the piston engine. These were geared to run at about the same speed, and thus produce the same quantity of steam as before.



Photograph No. 1. The Stumpf type turbine

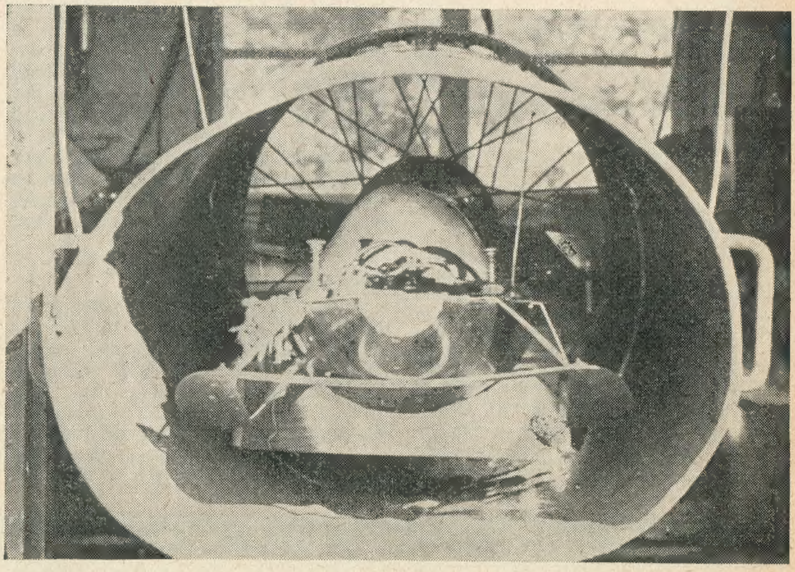
Stumpf Turbines

There was one difference in the turbine, this being the use of a different type of wheel. I had read an old book published about 1900 on steam and gas turbines, and in this book I found the "Stumpf" turbine. This is rather like a single-sided Pelton wheel, and has no blades as have De Laval turbine wheels, the steam being directed on to the wheel radially and escaping axially. Two examples are shown in photograph No. 1. It has several advantages from the constructional point of view. The buckets are made by end-milling, this being a very simple operation, and a complete set of buckets can be made in an hour. It is exceedingly strong, and having no weak blades, can be rubbed and seized with impunity. This type of wheel has very small windage losses, and partial admission (few nozzles) can be used without the high losses found on a De Laval turbine when using a small number of nozzles. I have proved this by driving the turbine through its reduction gear by an electric motor, the turbine casing being held in the hand. Even at 50,000 r.p.m. practically no torque is felt, so obviously very little power is being wasted.

Greater Efficiency

I have tested this type of turbine very carefully, and have used the same nozzle as the De Laval type, and at the same steam flow have found it to be about 10 per cent. more efficient. The only disadvantage that I can see is that it would be more difficult to stage, but as the advantage of staging small turbines is doubtful, I don't think it really matters.

I first ran this boat at my local pond, and I can't say that I was encouraged. The first time I pushed off, the plant stalled within yards, and I came to the conclusion that the propeller pitch was much too coarse for the reduction gear of about 4 : 1. I made a series of propellers, and finally finished up with one 2 in. diameter, and 2 in. pitch, and rotating at about 15,000 r.p.m. The boat would get away quite well like this, but always came to rest with the flame out. I am sure that water was being thrown up by the sponsons, thus damping the blowlamps. I got so fed up with it one night that I pushed it off free and, for once, it shot off and went straight as an arrow for about 200 yd. at about 40 m.p.h., before crashing into some reeds, where it sank under a pillar of yellow flame. I think the absence of line drag allowed just that extra bit of speed to get the boat well



Photograph No. 2. Wind tunnel operated by boat power

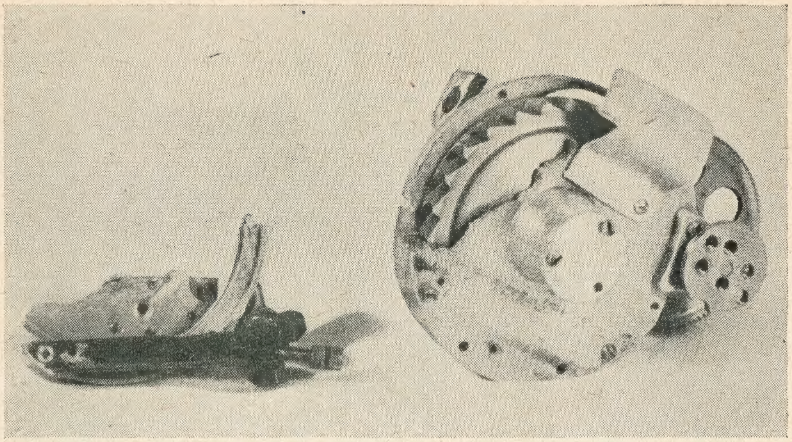
up on the sponsons and prevent water getting in.

One of the reasons for installing the turbine was to try and stimulate some interest, and to try and get someone else to have a go at building one. There is nothing like a bit of competition to stimulate progress. I ran it at Victoria Park, but it was on its usual bad behaviour, and would only do a lap or so before it blew out.

Wind Tunnel Work

No further pond running was done, and the plant was then run solely in the wind tunnel, which I described some time ago, the idea being to work up the power. I also intended to try to burst the turbine, and thus get some idea of the actual safe r.p.m., rather than a somewhat nebulous estimated one. Photograph No. 2 shows the boat mounted in the wind tunnel. Past readers will recognise this shot, but it is mainly for the benefit of those who are meeting it for the first time. Briefly, the action is as follows:

The boat propeller is removed and a small sprocket attached. This drives, *via* a fine-pitch chain, a large fan that, while causing a draught to simulate the boat's motion, absorbs the power from the engine. A great deal of running was done, and increasing turbine speeds were recorded, until one day when 75,000 r.p.m. had just been recorded, there was a loud bang, and a very abrupt halt. I really thought I had burst the wheel, but all it turned out to be was that the load from the water pump had split the wheel casing into two. This is shown in photograph No. 3. I was not really surprised, because the material was home-cast, and full of pin-holes. No trouble was experienced with the flame blowing out, so it was concluded that previous trouble was due to water getting in amongst the flame.



Photograph No. 3. The result of "expensive noises"

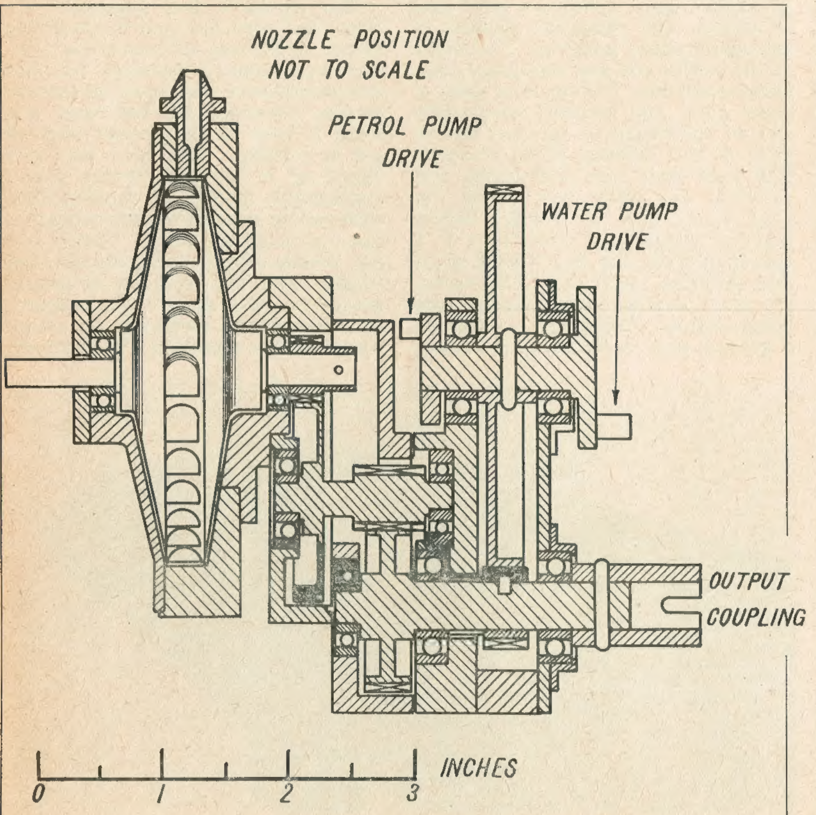
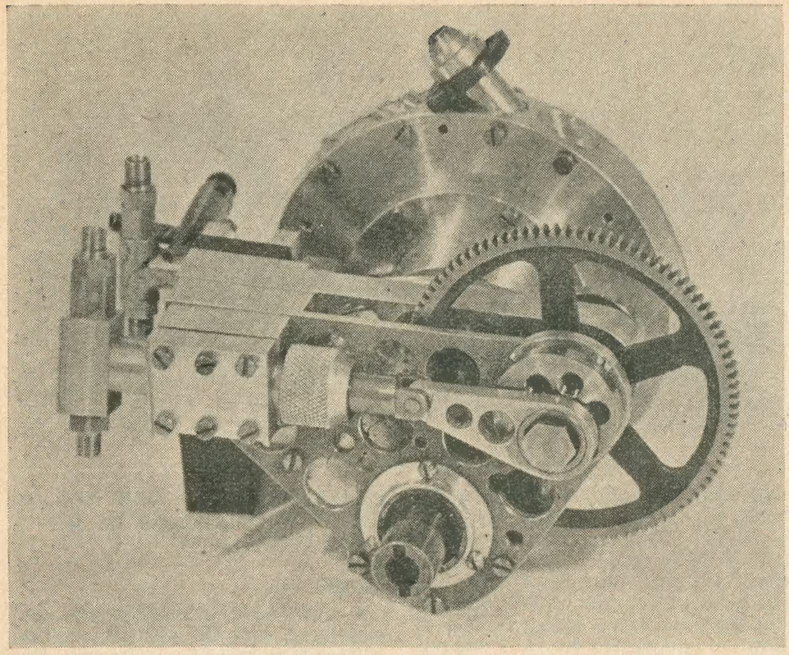


Fig. 1. Section of turbine and gearbox

Turbine No. 2

I now had a wrecked turbine, and was faced with the alternative of repairing it or building a new one. The choice was obviously a new one, and it was fairly plain what had to be aimed for in the new design. First, the reduction ratio must be increased, so that the wheel tip speed could be increased, and at the same time the propeller speed must be reduced so that a coarser pitch could be used. This means fewer turns per foot travelled and thus the friction of the water on the blades is reduced. One must not, of course, go too far, or the blades will stall, and friction again will call the tune. There is obviously an optimum pitch at which blade friction is least and the blade unstalled. Steamers as a rule are not very critical of propeller pitch, as are some highly-tuned i.c. engines, for the torque on a steam engine does not fall away as the revs. drop, steam being well known for its slogging power. In fact, it may well prove advantageous to gear the propeller to run faster than the engine. The friction losses in the engine would be down, and porting would be more efficient due to the lower gas and piston speed.

The reason for aiming at a higher turbine speed is that the tip speed of the wheel should run at approximately half the steam speed. In a good nozzle, using steam at 1-2,000 p.s.i. (readers may raise their eyebrows but I will relate later how these pressures were measured), steam speeds of 3-4,000 ft. per second can be achieved. I have never expected nor got a steam speed of much over 2,500 ft. per second, so I aimed at a wheel tip speed of 1,250 ft. per second. With a 3-in. diameter wheel, this represents approximately 95,000 r.p.m. It is an interesting fact that the wheel tip speed is greater than the famous "sound barrier." A search through my collection of gears produced



Photograph No. 4. Mk. 2 turbine with Stumpf wheel

a double reduction of 7.5 to 1, therefore at 95,000 r.p.m. the propeller would turn at 12,650 r.p.m. Using a very moderate propeller pitch of 6 in., this would give about 55 m.p.h., according to slip factor, that is if the power was available.

Accordingly a design was drawn up, and a somewhat straightened-out version is shown in Fig. 1. It will be seen that the new wheel approximates to a disc of constant strength, the straight sides being chosen for ease of machining. The material used was Nitralloy Grade 3, and the rotor and shaft were machined from the solid. There is no particular virtue in this material, except that it was available and had a specification from which calculations could, therefore, be made with some accuracy. If a random piece of metal is taken from the scrap box, its properties are unknown, and all calculations are fruitless. The wheel was calculated to have a theoretical extension of 0.01 in. at 100,000 r.p.m. and this was used to provide a safety device in the event of a broken propeller shaft or lost propeller. The case, being made of dural, was estimated to reach 50 deg. C. and would thus "grow" approximately 0.0015 in. A clearance of 0.008 in. was given on diameter, and at any speed in excess of 100,000 r.p.m. would cause the wheel to rub and thus prevent it going any faster. I may add that although 95,000 r.p.m. has been recorded, no rubbing has been evident.

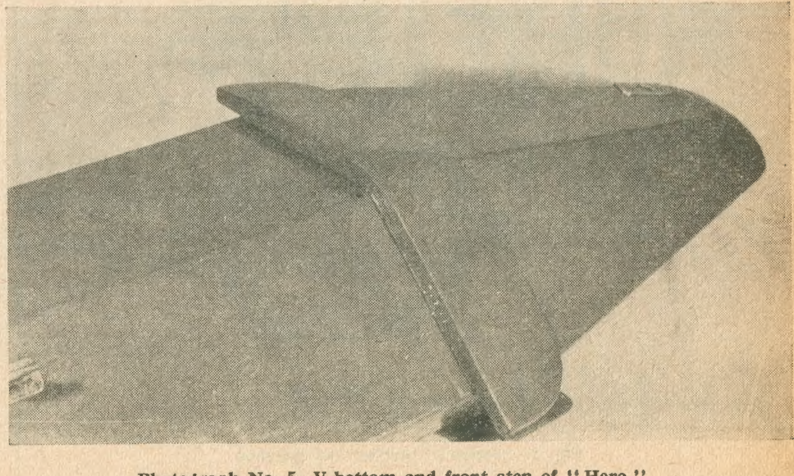
The steam buckets, of which there are 25, were made by mounting the wheel in a jig on the cross-slide and milling with a $\frac{1}{16}$-in. flat-ended cutter. The only things worth commenting on were: one, the huge pile of swarf, and, two, the weight of the finished wheel, which was 14 oz. This weight, revolving at 95,000 r.p.m., contains a good deal of energy, and effectively disposes of any getting-away problems. The whole of the turbine and gear casing was made bread-and-butter fashion from slabs of dural plate, and involved some tricky bits of machining to get gear centres right in two different pieces of metal. Ball-races were used throughout, and provided any water was cleared out after a run, gave no trouble. Water and fuel pumps were driven by a 5 : 1 reduction from the final output shaft and, therefore, ran at about 2,500 r.p.m., the usual variable stroke arrangements being retained. Photograph No. 4 shows a general view of the complete turbine.

It will be seen from the photograph that provision was made for four nozzles. It was hoped eventually that enough steam could be raised to supply all four nozzles, but up to the present only two have been steamed to capacity. Experiments with one or two nozzles of equivalent area have shown no difference in performance. The larger nozzle shows up better, because it was almost impossible to block, the size being 0.050 in. The two smaller nozzles, in the case, 0.020 in., were definitely a nuisance from this point of view. I tried steaming a single nozzle of 0.020 in., but only succeeded in bursting the boiler and making a lump like a hen's egg in the boiler casing where the steam hit it.

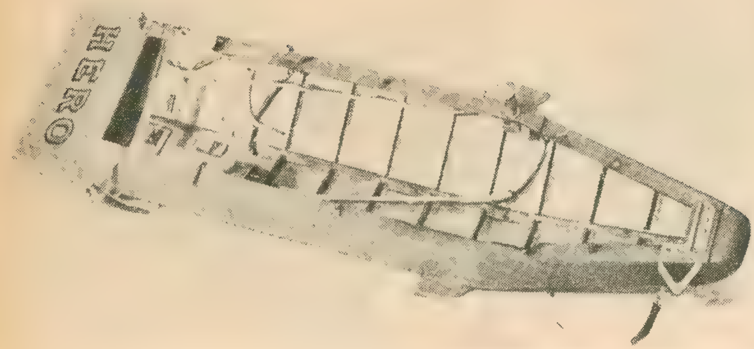
This turbine was first tested in the tin hull, a few days after Christmas, 1953, on a day when any sensible person would have had his feet up by the fire, the temperature being only a few degrees above freezing. However, when the desire to see the wheels go round gets you, all obstacles are brushed aside, and, provided the water is pumpable, down to the pond we go !

On raising steam and pushing off, the boat did two laps smartly at about 45 m.p.h., and then slowed down and sank. The new turbine, being $3\frac{1}{2}$ lb. in weight, brought the total weight up to that of the old piston engine, and consequently freeboard was negligible.

The inevitable had happened; the flame had gone out, and the boat had circled on the residual heat in the boiler and energy stored in the wheel. I decided not to run the tin boat again, as my new turbine contained ten ball-races, and when it went to the bottom they all got a soaking. The boat was next rigged up in the wind tunnel, and a considerable amount of running done with various nozzle sizes and configurations of boiler air entry. I never had any trouble with the fire going out, and 95,000 r.p.m. was recorded on several occasions. The turbine was stripped, and the wheel measured to check whether it was stretching. No extension



Photograph No. 5. V-bottom and front step of "Hero"



Photograph No. 6. Hull of flash steamer, "Hero"

could, however, be detected, and, as all gears seemed to be standing up well, a new hull was decided on.

The New Hull

A great deal of thought was put into the new design, and, as I had a couple of seasons of regatta experience to draw on, I had a good idea what I wanted. First, I must have a hull that did not have a tendency to "flip," which meant that it must have little or no aerodynamic lift. The second thing I wanted was a hull that could get away without hurling it forward, a practice which I deplore, and which should not be necessary. There are several well-known boats that are launched simply by letting go, and as they are amongst the most successful, it is quite obvious that a little research would enable all boats to be launched in a like manner.

I hoped to fulfil the first requirement by getting the boat well up on the water, and thus allowing air to spill from underneath. The second was achieved by making the hull vee-bottomed. I have no proof that the hull will not "flip" as I have only done about 55 m.p.h. for a couple of laps, however, without flipping. The vee-bottom certainly works for getting away, and, until I was talked into fitting some sponsons, it really looked like a boat. I intend to remove the sponsons, as I am sure they will cause a flip when really high speed is achieved, or, should I say "if"! I realised that a true vee bottom would make the boat unstable vertically, so I faired the vee into a forward step about 3 in. wide. This can be seen in photograph No. 5. The stern rides on a step 2 in. wide, which controls the depth of the propeller blades.

The hull is built of $\frac{1}{16}$ in. ply, and is ribbed on the bottom only. All corners are made with $\frac{1}{4}$ round strip, and glued with Aerolite glue. The hull, which weighed 3 lb. complete with paint, bridle and propeller shaft, would support my weight of 12 stone when suspended by the bridle. I have a morbid fear of a boat coming off the line, and this test was done, even though I ran the risk of smashing the whole thing to matchwood. Length is 41 in., and beam $12\frac{1}{2}$ in., and photograph No. 6 gives a general veiw of the complete hull, after a considerable amount of use.

A New Boiler Design

At the same time that I built the hull, I also gave a lot of thought to overcoming some of the problems of flash boilers. The main trouble was the ease with which the flame blew out when in motion. The second, although not so important, was the heavy fuel consumption. This, of course, was really due to inefficient use of the heat, by throwing a large proportion away at the rear end. I think I have evolved a boiler that does both jobs; it does not "blow" out, and uses about a quarter the amount of fuel that the previous one used, though it evaporates over two pints of water per minute.

The original blowlamp had four flame tubes and jets, and, although I had little trouble with blocked jets, doing modifications in quadruplicate was a bit tiresome. I therefore resolved to have only one flame tube and jet. The blowlamp is really an elaboration of the roaring type of Primus, except that instead of a flat plate for the flame to stabilise on, it uses a cone. Fig. 2 shows the layout of the blowlamp.

(To be continued)

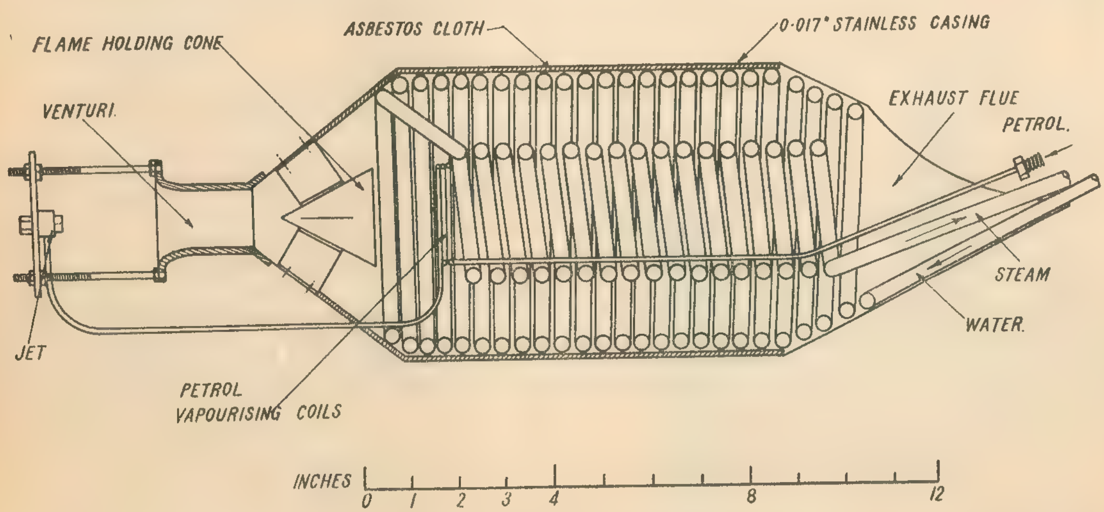


Fig. 2. New type boiler and blowlamp

A SENSITIVE DRILL

By

B. Terry Aspin

EVERYTHING went well and I produced two likely-looking castings at the first attempt—or so I thought until machining commenced on No. 1. Then I had the surprise of my life ! For no apparent reason at all this particular casting turned out to be as hard as the toenails of the very gentleman (the patron saint, so to speak) usually associated with furnaces. Carbide tips simply *bounced* over it and when, eventually, I did succeed in removing the outer layer I discovered that it was riddled with small holes throughout its entire structure. I have never seen anything like it before !

Fortunately, the home foundryman has a remedy for faults of this nature. He simply blows up the furnace and casts another one !

Continued from page 368, *March* 31, 1955.

There *was* a little hand work in the moulding of the bracket casting as, like the jockey bracket, it had to be "dug into" the sand to an irregular joint line. But there were no snags and, being small, it could be cast side by side with the circular table in the same box. With the latter, again, I had one misfortune. Where possible it is usual to cast an important surface downwards; impurities and faults tending to find their way to the top of the mould. For that reason the table was moulded upside down in the cope part instead of in the drag; the elongated boss, incidentally, being extended upwards to form a "feeder" (Fig. 24). Noting that the four slots, after drawing the pattern, left somewhat feeble-looking cores—and these to be upturned later when the mould was closed—I took steps to reinforce them with snippings of iron wire (Fig. 25). In actual fact, the pattern is returned to the mould to support them while all this is carried out, and I find soft binding wire, from packages very suitable for the purpose.

This precaution proved quite satisfactory in the first casting but, on shaking out the second mould I discovered that one of the slot cores had swivelled round, intact, to an awkward angle on the very wire I had put to support it. The reader can imagine my chagrin when this turned out to be the only fault on the casting; and this spoiling its appearance rather than its utility. Again the same remedy, this time using *two* wires per core instead of one.

Awkward

Had I been satisfied with a boss on the baseplate the same height as the bed machining, on a $3\frac{1}{2}$-in. lathe, would have been much simpler. It *may* have been adequate, but I liked the look of the extra support to the column offered by the deeper boss. Either way, the height of this had to be no greater than would pass between the faceplate and the bed of the lathe in the gap, or the job couldn't be machined at all. As it was, work had to be commenced by drilling the four holes in the lugs and a fifth in the centre of the plate, before there was any means of securing it.

The first cut was taken across the underside, the work being held, mainly, by a long drawbolt, passed right through the mandrel and the centre hole in the casting, and nutted up either end. Packing was inserted under the shallower section to bring it level, and a headless bolt, in one of the faceplate slots, entering one of the four drillings to prevent rotation (Fig. 26).

The real problem was the upper surface of the bed. On a larger lathe the boss could have been located at the centre of the faceplate and bored there,

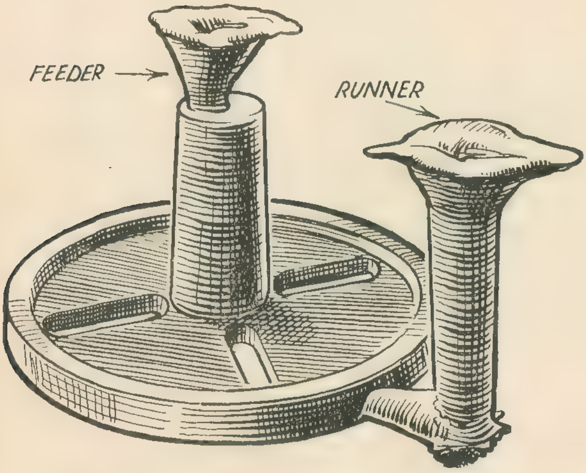


Fig. 24. Sketch of unfettled casting for drilling table. The "feeder" helps to make up for contraction in the deep section as the casting cools

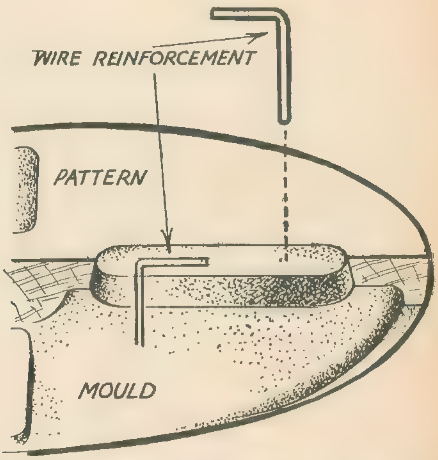
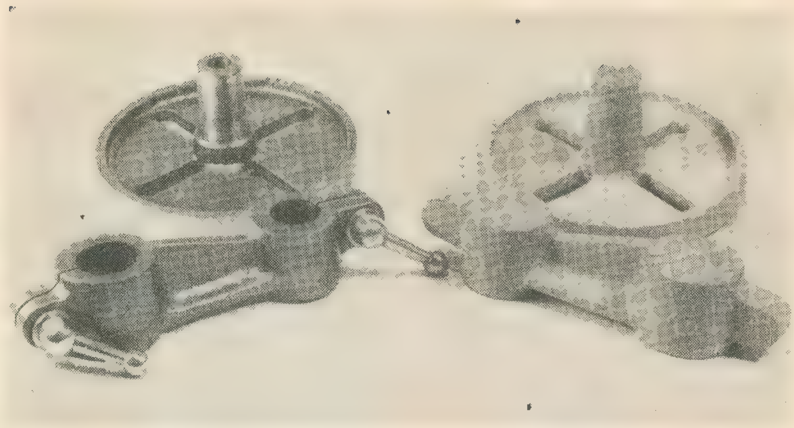


Fig. 25. Strengthening the greensand cores which form the slots in the table. Pattern shown part-sectioned

no doubt, while the rest of the casting was turned at the full swing. In this case the casting had to be re-mounted in three different positions on the face-plate before machining could be completed (Fig. 27). Boring was carried out on the vertical slide in the same manner described for cross-boring the head-stock.

Another repetition of history was the boring of the bracket, carried out as for the parallel bores of the headstock, except for the table end being bored $\frac{3}{4}$ in. instead of $\frac{7}{8}$ in. Neither did I use the floating cutter. The length was not there to demand it and I had found the 4-jaw "boring head" so convenient, when fitting to a bar, that I made use of the method in preference. The measuring device was used to good effect so that, on the assembled machines, the chuck taper drops cleanly into the centre hole of the table.



Photograph No. 7. Drilling table assembly with patterns

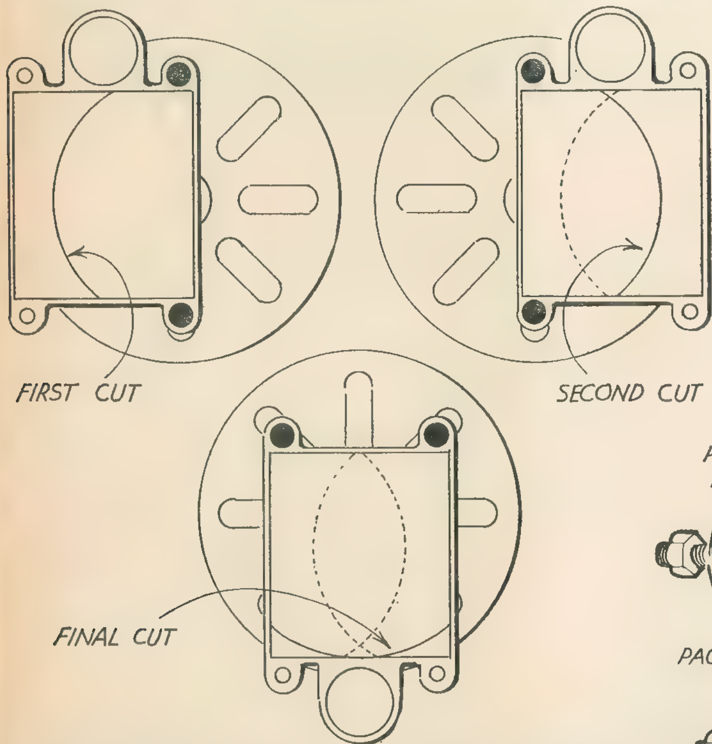
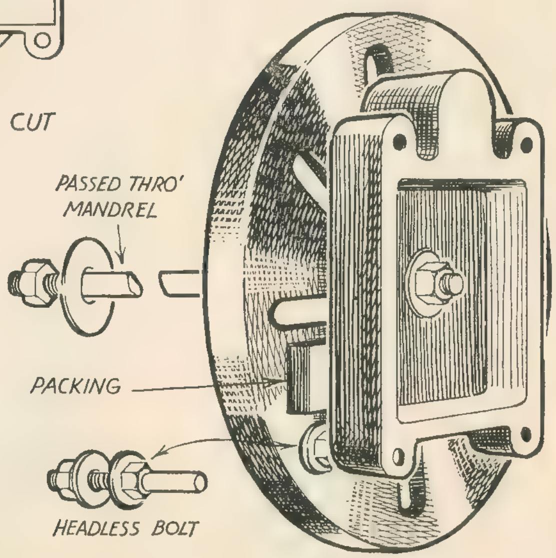


Fig. 27. Machining the upper surface of the baseplate. Two positions nearly did it, but the third was necessary to remove the final scrap near the pillar boss



Right: Fig. 26. Base casting on the faceplate for machining the underside

The remainder of the work to complete these sensitive drills barely warrants description. I was extremely happy to discover that my drilling tables turned up without a flaw. The slightest blemish would have ruined them. For an interlude, at least until the next job, I was quite content to leave the work on cast-iron and turn to the cleaner task of machining the light-alloy pulleys. (Now I know why early iron-workers were called *black*smiths !) The last job of all was the ball-handled clamp-bolts for the drilling table bracket. I am the proud possessor of a $\frac{5}{16}$ in. capacity Coventry die-head, which helped to carry out the work most expeditiously—even when used as a glorified tailstock dieholder !

No ! There's nothing *much* to making a drilling machine !

Model Power Boat News

BY MERIDIAN

ACTIVITIES IN THE U.S.A. AND CANADA

Ed. Kalfus with his 30 c.c. racing hydroplane, the former Class " B " world's record holder

ONCE again we are indebted to Bob Graham of the New York M.P.B.C. for some news of American speed boat activities. He has also sent some excellent photographs, which are reproduced with this article.

Most of the written information concerns regattas held towards the end of last season, and it is evident that the speeds were well up to the high standards reported in the previous articles about our American colleagues.

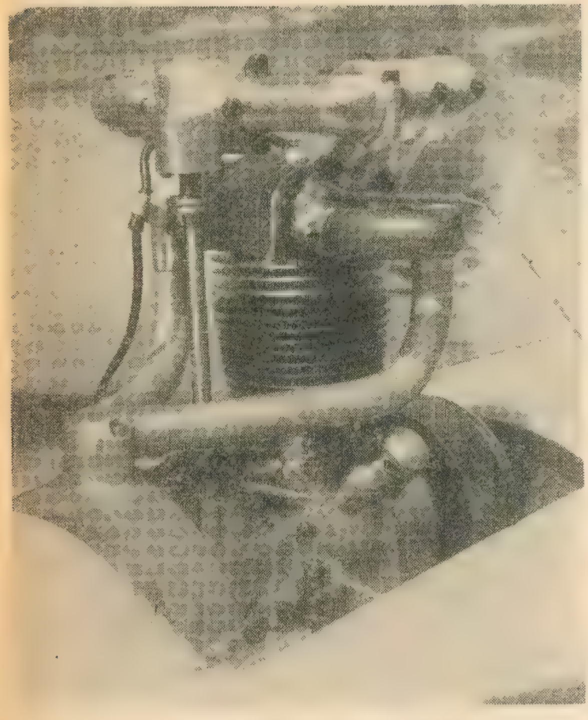
Two of the World Record speeds were raised still higher by the close of last season—Class " C " (15 c.c.) and Class " D " (altered or home-built 10 c.c.). The 15 c.c. record was achieved by Walt MacWilliams (Philadelphia) at a race held in Baltimore, and the new record is 81.44 m.p.h. This is very much faster than the best 15 c.c. speeds attained in this country, and should spur our exponents in this class to greater efforts, although it should be remembered that conditions generally play a big part in record runs. In Britain, ideal climatic conditions are seldom encountered, and it is significant that many of our best performances have been set up abroad, either in Paris or Geneva. On the rare occasions that good weather conditions prevail at our regattas, it is likely that the water is not very suitable for very high speed, due to backwash or something !

The Class " D " record was raised no less than three times in the course of last season—twice by Bob Colson (Detroit) who attained 79.64 m.p.h. at the Detroit International Regatta in July and a fortnight later raised it to 81.81 m.p.h., also at Detroit, this time in a inter-club race. At the Toronto International Regatta held at the end of August last, the record was broken again, but this time by a member of the Toronto Club—Bill King. The speed recorded was 84.9 m.p.h., and one of the photographs shows the new record holder with his boat, and with him on the right is Bob Colson, who is offering congratulations for this fine performance.

The net result of the raising of these two class records means that all of the chief classes (30 c.c., 15 c.c. and two 10 c.c.) have world records in the eighties, but British enthusiasts should not be unduly depressed by this. Judging by the speeds attained in other races, I feel sure that many of our boats would stand a good chance of being placed, if it were possible to compete under the same conditions. In actual fact, I would hazard a guess that that in the 30 c.c. and 15 c.c. classes the *average* speeds put up by our leading exponents might be somewhat better than those of our colleagues. I refer to the apparent dearth of really fast boats in these two classes, apart from the record-holders, and one or two others, whereas in this country there are quite a number of craft that compete regularly in 30 and 15 c.c. events that are capable of similar speeds, even if these speeds are well short of these remarkable records attained in the U.S.A. and Canada.

Bill King (left) holding new Class " D " world's record holder with Bob Colson

The other photographs also present some interesting items. Ed. Kalfus is shown with his 30 c.c. boat (a former record-holder at 80.36 m.p.h.) and the



The Class "A" 47 c.c. engine with supercharger running at four times engine speed, built by Herb Zieman

unusual design of the hull is shown well. Ed. Kalfus has, I believe, always favoured rather deep hulls, and not much of the engine projects above the deck in this design. The hull is 30 in. long by 12 in. beam, and the sharp lift of the tail from the waterline bears a marked similarity to Tom Dalziel's *Naiad* 2, which is a well-known performer at regattas in this country. The short and stubby sponsons should also provide food for thought for designers of racing boats. The total weight of this boat is 11 lb., which is very reasonable for a 30 c.c. craft.

The overhead-valve four-stroke engine illustrated has a capacity of 47 c.c., which is, of course, somewhat larger than the maximum capacity allowed in Britain. The American "A" class, however, allows an unlimited cylinder capacity, provided that the all-on weight of the boat does not exceed 16 lb. Although not actually stated, the engine appears to be of the overhead camshaft variety, presumably using bevel gearing to transmit the drive.

The builder of the engine is Herb. Zieman of Detroit, and he is to be congratulated on a very workmanlike job. The engine is supercharged by a blower geared up 4 : 1 in relation to engine speed, and since the output from this blower is divided and led either side of the cylinder, it must be assumed that the engine has four valves—two inlet and two exhaust—although this is an unusual arrangement for a model racing job. The speed so far attained has not been in the record breaking class, but over 50 m.p.h. has been exceeded on many occasions. The engine looks good for much more than this, and no doubt will attain higher speeds as development proceeds.

Finally, a most interesting twin-cylinder 30 c.c. two-stroke job by Ernie St. Antoine, of Windsor, Canada, is illustrated.

The engine is horizontally opposed, and is fitted with a built-in magneto. Glow-plugs have been tried, but the speed was not as good as when using the spark ignition provided by the magneto. Presumably the cylinders fire simultaneously, as is common with most opposed engines of this type, and the single carburetor would seem to confirm this. The rather unusual position of the carburettor makes the induction system of the engine somewhat of a mystery, unless some sort of reed-valve is employed to control the induction events.

The most interesting feature of all concerning this engine is that a gearbox is incorporated giving a propeller speed greater than the engine by $1\frac{1}{2} : 1$. Now, the speed achieved is no less than 67 m.p.h., which makes it appear that there may be something in this gearing-up business!

Full-size racing boats that employ the surfacing principle nearly all use a geared-up propeller, as the large engines used cannot reach the revs. necessary to attain high speeds, but this is the first time I have heard of a successful model speed boat with a geared-up propeller.

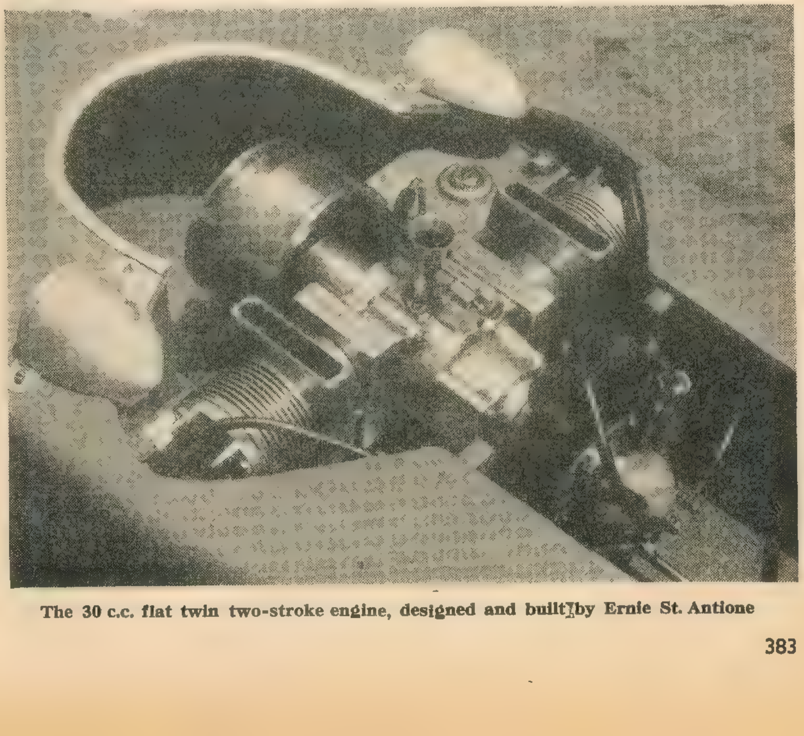
As I have mentioned before, however, I see no valid reason why it should not be advantageous in some cases, and particularly in the case of flash steamers, where great power can be developed at comparatively low revolutions.

Unfortunately, no details are available of the gearbox, but I should think that fairly substantial gears would be required to transmit the power developed by an engine of 30 c.c. capacity. The builder of this engine has another reason for congratulation, and that is the performance attained by a design with more than a single cylinder. There have been many engines made with twin cylinders, but the successful ones have been few and far between.

I conclude by thanking Bob Graham for sending us these interesting items and to wish him and his colleagues the best of luck in the coming season.

The 1955 M.P.B.A. Regattas

I would like to draw readers attention to the list of association regattas published in the March 17th issue. Make a note of them in your diary, and come along to see model speed boats in their element.



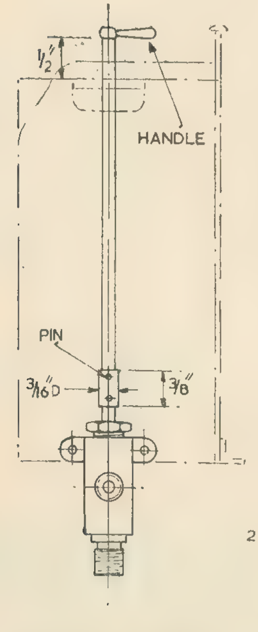
The 30 c.c. flat twin two-stroke engine, designed and built by Ernie St. Antione

TWIN SISTERS

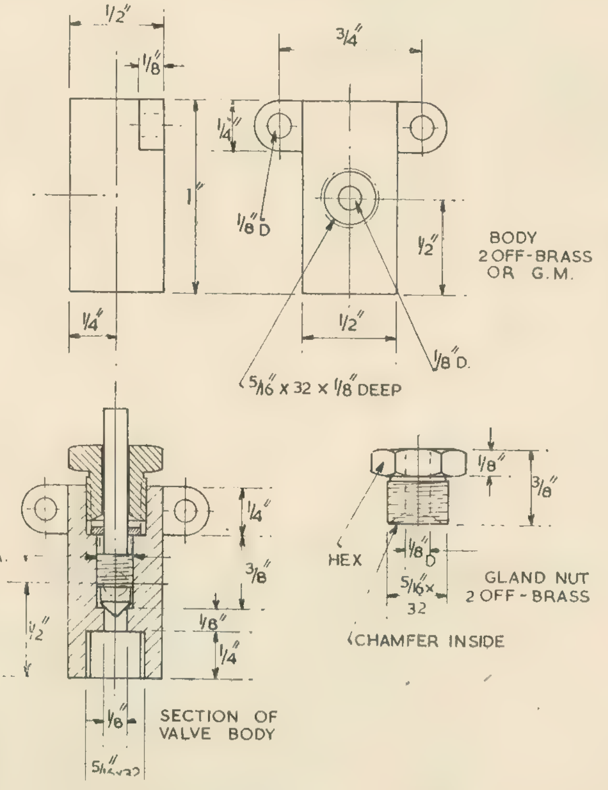
By J. I. Austen-Walton

THE drawings with this instalment show details of the two water valves, one for the injector feed and the other for the axle pump by-pass. Their construction is extremely simple, and their "innards" follow my usual practice for this type of fitting. In the case of the injector feed valve, the inlet is to the top connection, and is thus a reversal of the normal and accepted practice; but, as we are dealing with water under gravity (and about four inches head at that !), we are not likely to run into leakage trouble. Connecting the valve in this way, permits of a clean, straight run from the side tank *via* a neat elbow fitting underneath the platform, to the valve, and from there, an easy, falling bend to the injector itself. The axle pump by-pass valve is connected up in the "correct" manner with its lower connection running to a "tee" in the delivery pipe from the pump and through the water manifold fittings, as shown on a recent drawing. The connection from the valve to outflow would be through another elbow situated somewhere on the back edge of the right-hand side tank, or *via* a visible siphon pipe discharging through a generous hole in the side tank top-plate.

All this applies to those who are *not* fitting anything other than the axle pump. My own twin has this valve arrangement reversed, and I now regret this, somewhat. The bunker by-pass valve I use as the steam pump release valve (as described recently) and the axle pump by-pass on the side tank end, and it is the latter which is used more often and would have come more conveniently to hand at the bunker control. When time permits, I must swop these two around.



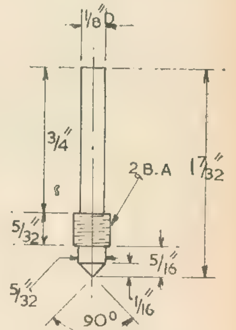
VALVE FOR INJECTOR WATER FEED & BY-PASS VALVE. 2 OFF



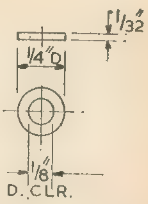
BODY 2 OFF-BRASS OR G.M.

SECTION OF VALVE BODY

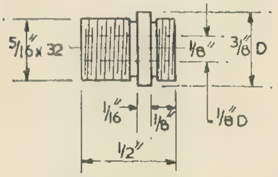
GLAND NUT 2 OFF - BRASS



VALVE SPINDLE 2 OFF. ST. STEEL



PACKING WASHER OFF - BRASS

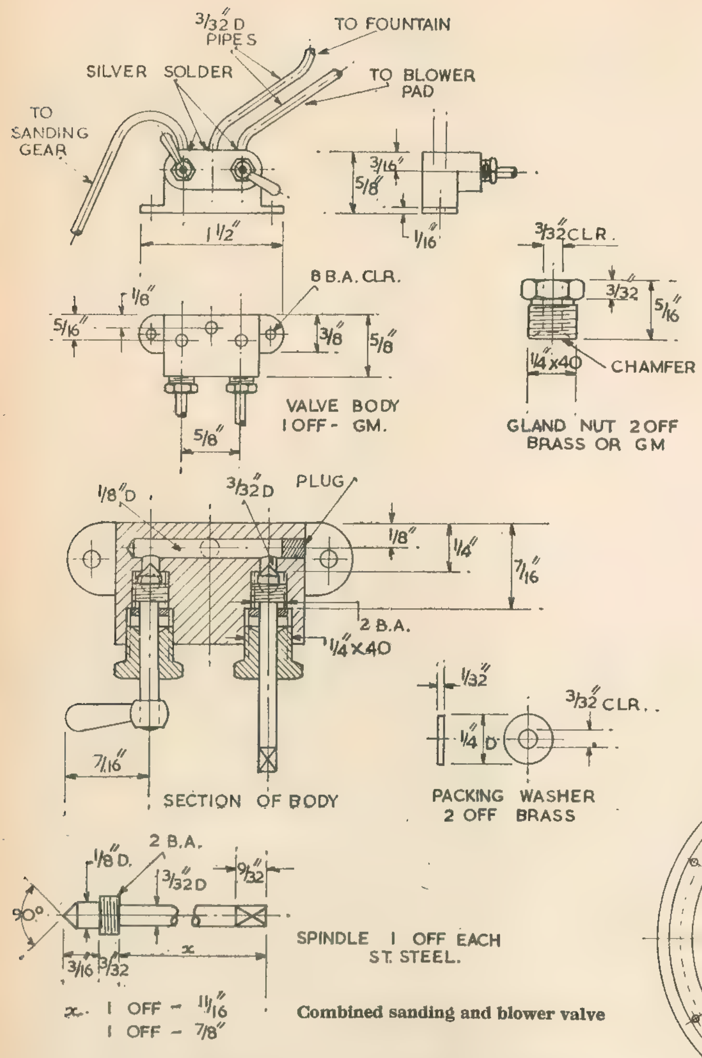


UNION 4 OFF - BRASS

Combined Sanding and Blower Valve

This should have been described a long time ago, but as I had some trouble in this department, I decided to carry out a post mortem before presenting the complete fitting. The original trouble was lack of steam pressure at the blower ring, and the hollow stay through the boiler was suspected of being a bit too small in the bore. To get over this in time for steaming and tests on the track, an auxiliary valve was fitted, and an external blower pipe. This put everything right, and the original valve was put away for examination at a later date. A glance at the drawing shows it to be quite orthodox and with adequate passages for steam for both its designed purposes. The trouble came about with the silver-soldering of the central pipe, and I fear some of the solder flooded the main inside passage, resulting in a very reduced way for the steam. Again, when there is time, I shall remake the entire fitting and restore it to service. The unit, incidentally, fits on top of the firehole door fitting, where it is to be found on the prototype, and the long pipes allow

Continued from page 244, March 3, 1955.



Combined sanding and blower valve

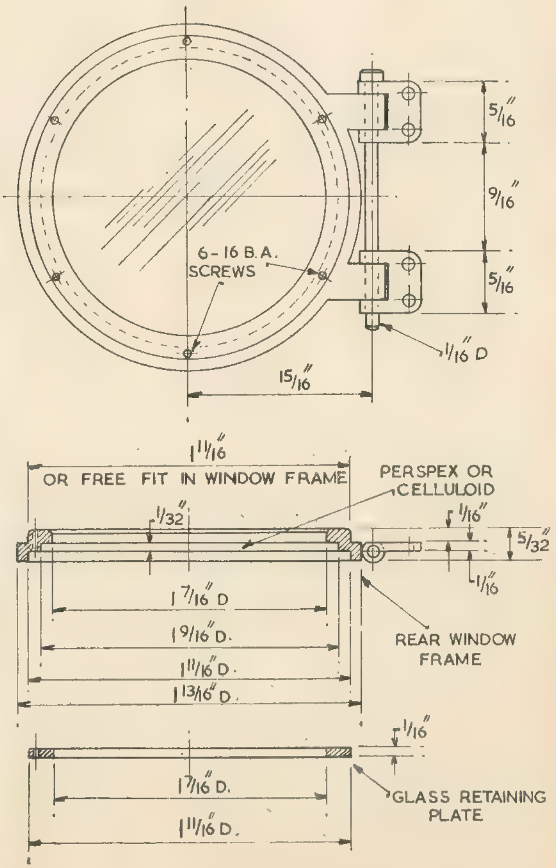
for final unions or connections to be made on and the pipes shaped to a clean and neat layout on the backhead. For example, it was found to be most convenient to terminate the sanding pipe in a union about halfway down the side of the firehole door. From there, the service pipe carried on to a harness under the footplate, feeding all four sanding units. The pipe marked "to blower pad" would, of course, terminate at the little backhead pad already described, whilst the connection to the fountain would provide a steam feed for both services.

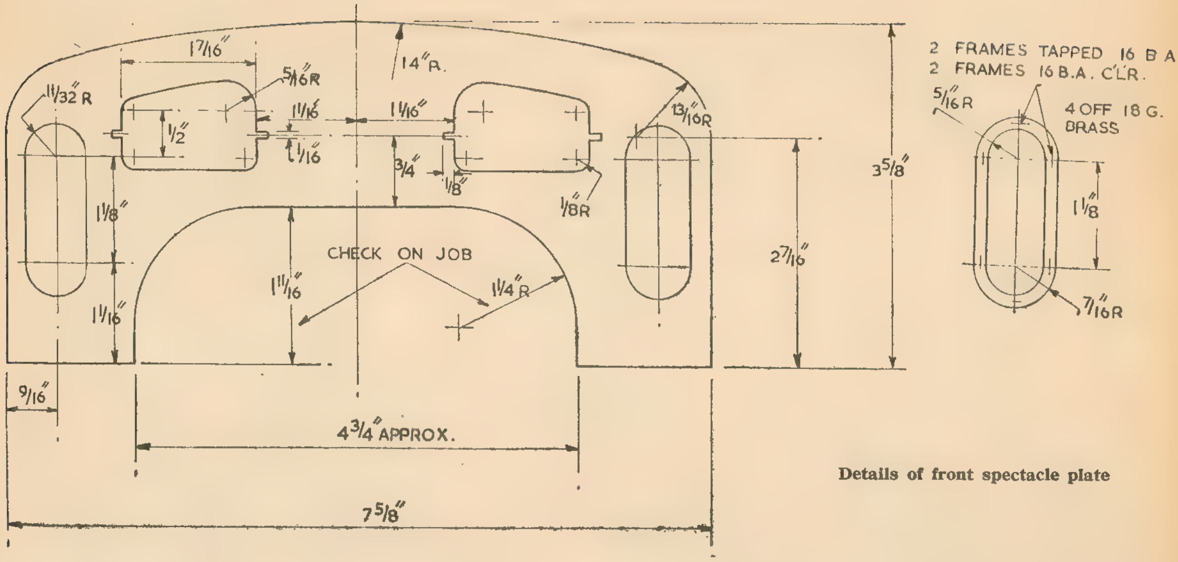
The only points to watch when making the valves, are that the spindle valves should be of different lengths as shown, and that the handles (or, at least, the sanding valve handle) must be short enough to swing past the other spindle. At first glance, when the fitting is in place, it looks as though the handles would foul the opening of the firehole door, but with both handles left down, there is still plenty of room for the door swing.

The Rear Windows

Those who enjoy good, working details, will have fun making these! But let us consider them first in their simplest form—for *Minor*, shall we say. Nothing could be more elementary than plan brass rings, unglazed. I have seen a great many well-made locomotives both at exhibitions and on the track, sporting nothing more than this rather inadequate type of window, and I'm sorry to say I don't care for such complete disregard for detail. Fixed windows, with or without gratings, alter the whole appearance of a job, and I can hardly believe that cutting out a few bits of glass or Perspex can be so very troublesome and deter so very many of you builders of good locomotives.

The correct window is here shown, and is nothing more difficult than turning up a couple of stepped brass rings and flat retaining-rings to suit. Simple lugs are silver-soldered to the stepped ring, in the position shown; everything is flat and flush, so the final facing may be left until the lugs are in place, when they are faced off neatly with the rest. I recommend thin Perspex for the glazing, which can be cut out and filed or ground to the size required. It is when the 16-B.A. screws are noted that the trouble brews up—but why? These little round-head screws are a standard watch item, obtainable from most of the Clerkenwell watch or instrument stores, and one 16-B.A. tap (2nd only required) will not cost a fortune. The actual tapping is so easily done in a thin section such as the window frame, that it will not be found necessary to use a tap wrench at all. Just jamb the shank into a tiny piece of wooden rod or the chuck of a pin-vice, and spin it between the fingers. It is when I ask you to tap blind holes in stainless-steel for 16-B.A., that I shall expect you to cry out in genuine anguish!





Details of front spectacle plate

The Front Spectacle Plate

The plate itself is simply a piece of flat brass with openings marked out as shown. This should be "saddled" out until it fits neatly over the firebox lagging (or, as some builders prefer it, on the firebox itself and butting hard up to the edge of the lagging). The lower edges, or "feet," of the plate should rest on the side tank tops without any tendency to lift. There is no need for angle fixings at these points, nor room to fit them; so the only direct attachment will be the thin fillet flashing which goes in front of the plate, and effects a neat joint with the firebox lagging.

But the window frames call for some comment. These are four in number; two opening and two fixed. The prototype has four opening windows, those on the sides swinging on hinges and secured by locks as on the rear windows. Sheer lack of space and the impossibility of getting to open or close them, made me decide to fit fixed frames, so that will make the job so much easier. The opening windows swing on central, horizontal pintles or hinges, and are made up in three separate parts, sandwich style. First, make the centre plates with the spigots as shown, fitting them carefully to their respective openings. File the hinge pins to circular section (nothing very critical about this particular operation) and drill for the screw holes. The outer section of the frame (with the weather flash extended *below*) is now cut out, noting that the centre aperture is a little smaller all round than the inner frame; this is to house and retain the glass or Perspex. Mark out and drill the screw holes from the inner frame, temporarily fix together and file the upper half to a matching profile. Now make up the inside section in the same way, fixing the parts together and filing the lower profile to match. Make up the "glass" to fit the inner or middle frame, screw all three parts together (screw heads on the outside) and it should be possible to assemble the completed window frame in its respective opening. Make up little retaining plates to go each side of the pintles, securing right through with 16-B.A. screws tapped into the inside plates. Hey-presto!—little windows which open by swinging out from the bottom of the frame. Absolutely nothing to it, but careful filing and finishing and, if you are wise, a little lacquering into the bargain.

The End is in Sight

I don't know how long ago it was that I imagined our coming to the end of the little story of a locomotive which was going to be different, for now we have almost reached that stage, and the next instalment will include the last of the many drawings which have kept me busy so often into the early hours. The last of the drawings, showing the cab, cab doors and floor, is now in course of preparation, but that does not mean that I shall be able to relax and do nothing. Our editor has agreed to publish a supplement, showing the driving truck tender which, for all serious track working conditions, is as useful and necessary as the pricker and shovel, and with this I hope to conclude with some hints on general care, maintenance and driving notes.

Workshop Note

I see the now popular tungsten carbide tool has come into the limelight recently. It would appear that one must never take common sense for granted these days, nor recommend for use, any tool or appliance without giving very exact details concerning its proper usage.

If I were to possess a single carbide tipped tool, and no means of regrinding it in the event of its meeting some slight mishap to its cutting edge, I would be a bit shy about rushing into a very rough casting at top speed—especially if my lathe had slight or shaky bearings. Tungsten carbide is used extensively in the rough and tumble of high-speed production, and more often than not is in the hands of operators more concerned with "bonus bashing" than with the finesses of machining. The makers of the cemented carbide tip, know all this, and have been sensible enough to produce varieties of tips for all kinds of cutting—and abuse. To name but one, "Protolite" market a tool, grade W.6, that appears to be indifferent to the rigours of shock through intermittent cutting, which is a severe enough test for anything. During my last visit to the Machine Tool Exhibition at Olympia, I watched a demonstrator hacking his way through the outer hardened shell of a ball-race, the tungsten carbide cutter running at a cool 15,000 r.p.m. or higher, and completing its job of ploughing right through a glass-hard steel bearing without damage to itself. There are many grades of tungsten carbide these days, and the shock-resisting varieties cost no more than the others. Best of all, learn how to use the stuff, invest in the comparatively cheap luxury of a "green-grit" wheel for the grinding head, and a slip stone of the same compound. The latter costs only a matter of a shilling or so and, kept always in a little jar of paraffin, may be used to impart a real cutting edge after any regrinding operation. But there is more to it than that. You cannot use a tool with a positive top rake, or one ground to a sharp point or edge, unless you

(*Continued on page* 389)

A 10 c.c. General-purpose Four-stroke

By Edgar T. Westbury

TO complete the machining operations on the crankshaft, a keyway is cut in the main journal to provide positive location for the timing pinion and other components. This could be end-milled, so as to provide " stopped " ends, which hold the key endwise, but for such narrow keyways, I have not found end-milling very satisfactory, and have obtained better results by side-milling, using a small diameter cutter as used for " half-moon " or Woodruff keys, but traversing the cut instead of plunging it to maximum depth. The shaft may be held for this operation by chucking over the disc end, supporting the outer end of the journal on the back centre, and running the cutter in a milling spindle. Alternatively, the shaft may be clamped to the vertical-slide, and the cutter held in the lathe chuck.

Some constructors may object to running the engine with an unhardened crankpin surface, and I fully agree that hardening would be highly desirable, but there are many practical difficulties in carrying it out satisfactorily. If the shaft is made from the solid, there is great risk of distortion in any heat-treatment applied after machining is completed, whatever kind of steel is used; and a brazed shaft is also best left alone in this respect. I have found, however, that if lubrication is properly attended to, and the bearing metal of the big-end is suitable, the wear on the crankpin is by no means excessive, even when the duty is very heavy. My original " Kiwi " 15 c.c. engine, which had a mild-steel crankpin, survived a very hectic life on the test bench and in two or three successive speed boats without any very pronounced shaft or bearing wear.

I have examined several possibilities in providing a hardened crankpin surface (including the shrinking-on of a case-hardened sleeve, which is not such a simple proposition as it looks), and I have come to the conclusion that the most satisfactory solution, for those who insist upon it, is electro-deposition of a thin layer of hard chrome. There are several firms who now undertake this work, which incidentally is a very much simpler proposition when dealing with steel shafts than deposition on aluminium, as referred to earlier.

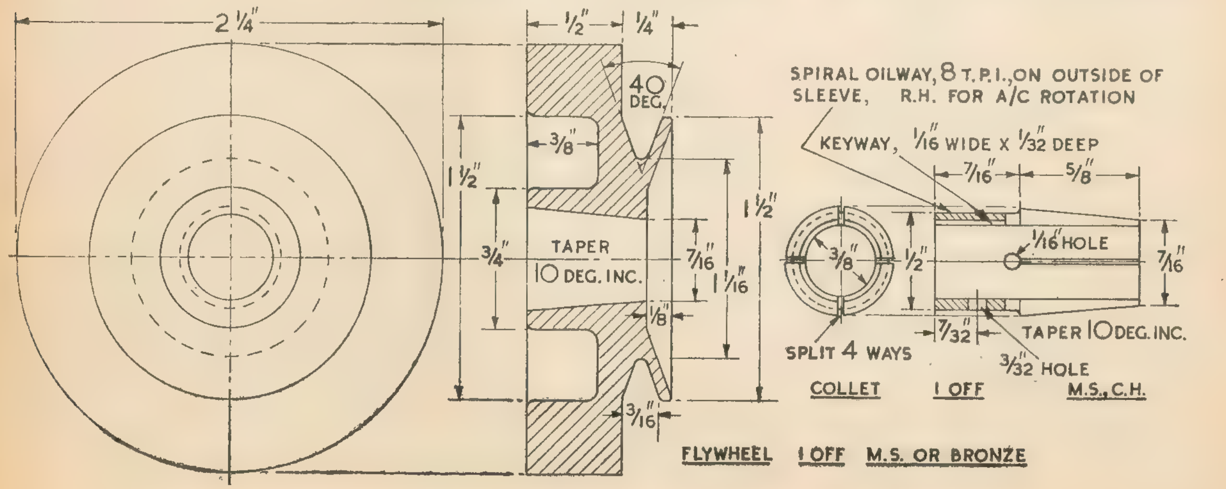
Continued from page 331, March 24, 1955.

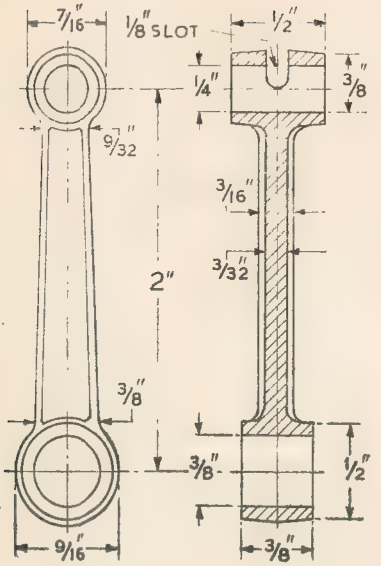
Flywheel

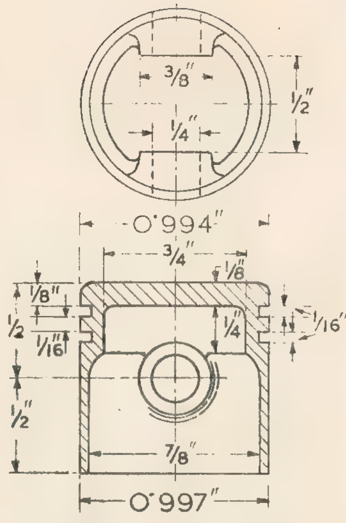
The most satisfactory material for this is steel, though other metals, including cast-iron, have been successfully used, at least for moderately high-speed engines. According to information available in statistical reference books, cast-iron flywheels are not at all safe at high speeds, but a great deal depends on the quality and soundness of the castings, and it is a good thing to err on the side of caution in these matters. One objection to the use of castings in any metal for high-speed rotating parts is that the presence of porosity, blow-holes or any lack of homogenity may throw them out of balance, which in itself is a possible source of trouble. A high-speed flywheel should always be properly in balance, taken by itself, and it is worth while checking this if any possible doubt exists. In no case should any attempt be made to correct engine balance by introducing bias or counterweight in the external flywheel.

In recent years there has been a tendency to reduce the size of flywheels used on small i.c. engines, primarily with a view to keeping down the total weight of the plant and improving the rate of acceleration. As engine speeds increase, the amount of mass required in the rim of the flywheel to store kinetic energy, or momentum, decreases enormously, but it should be remembered that an engine is required to start up and accelerate under its own power from a relatively low initial speed (imparted to it by the starting gear) and an engine with a very light flywheel will have a high stalling speed, making starting difficult and speed control quite impossible. Another point is that a four-stroke engine requires practically twice as much flywheel momentum as a two-stroke (for a given number of cylinders), as it has to carry the moving parts over two revolutions to complete the full cycle between power impulses.

The size of flywheel shown may be taken as the smallest which can be recommended for this particular engine, to provide a fair range of speed control and cope with normal working conditions. If convenient, a larger flywheel







PISTON 1 OFF L.A.

may well be used, and this does not necessarily mean increasing weight in relation to size, as the concentration of the mass into a rim of larger diameter vastly increases its effect. In most cases where small i.c. engines are used, however, and particularly in boats, there is a definite limit to the size of flywheel which can conveniently be employed.

I am often asked to give a "formula" for calculating the size of flywheel required for a given engine, but though I do not suggest that it is impossible to produce one, the various factors involved would make it very complicated—perhaps so much so that the much-despised "rule of thumb" would work out quicker and more certain in the end. Apart from the fact that it would be necessary to find out exactly how much work the flywheel would have to do between power strokes, in overcoming friction, air pumping, and valve operation, at the minimum working speed, the calculation of the energy which can be stored in a flywheel is quite a little mathematical problem on its own, involving first of all, computation of the effective radius of the main concentration of mass. That is one of the troubles of "working to formula"—it takes about half a lifetime to find the figures on which to *start* getting one's teeth into the actual problem!

The flywheel should in all cases be machined all over, and the method I recommend is to chuck it first with the pulley side outwards and rough out all accessible surfaces, including the pulley groove, side faces and as much of the rim as possible, to within about 1/32 in. of the finished size. It is then reversed, and the back face, recess, and the remainder of the rim turned, after which the centre is drilled and taper bored. Great care must be taken to get this bore perfectly smooth and true, the boring tool being set exactly on centre height to ensure that the taper is geometrically correct. The flywheel may now be removed from the chuck and mounted on a true-running taper mandrel for finishing the external surfaces; to avoid the need for making a special mandrel for a one-off job, the flywheel collet, in the course of its production, can be made to serve the required purpose.

Flywheel Collet

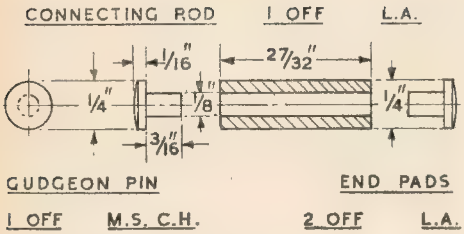
The object of using a separate split collet for mounting the flywheel on its shaft is primarily to provide a larger friction surface than is possible with direct mounting, and also to enable the shaft assembly to be clamped endwise by the single flywheel nut. I have always been a firm believer in the policy of providing an emergency overload slipping device for the flywheel, and I am quite sure that on many occasions my engines have been saved from complete destruction or major breakdown by this provision. The flywheel is held quite securely to withstand all normal torque strains by the taper fitting, but in the event of a sudden stoppage, such as, for instance, by the engine taking in a charge of water when the boat capsizes, it is capable of slipping to release surplus energy which might either shear the flywheel key, bend the shaft, or fracture an important working part such as the connecting-rod, piston or cylinder.

Many years ago, I worked for a firm which made motor-cycle engines with outside flywheels, and for a time we carefully fitted these with sunk half-moon keys, despite which we got quite a lot of trouble with torn shafts and seatings, sometimes before the engines had been very long in service. We spent considerable time in checking the fit of the tapers and the keys, fitting keeps to the nuts, and so on, without the least improvement, until in despair we left the keys out—and had no further trouble whatever! This, I have since learned, is by no means a unique experience, and I believe that even up to the present day, one of the best-known makes of two-stroke engines avoids the use of a key in the flywheel.

The collet can be turned at one setting from a piece of mild-steel bar held in the chuck, and the most important point is to make the taper a really good fit in the flywheel. "Mechanic's blue" or other marking colour may be used to ensure that it fits properly all over the surface, and the use of a fine Swiss file for removing the last high spots should not be despised. Do not attempt to lap or "grind it in" with abrasives. The size should be adjusted so that when inserted, the small-end comes to within $\frac{1}{16}$ in. of the front face of the flywheel seating. As already mentioned, it may be used at this stage of the proceedings as a mount for finishing the flywheel, and, for this purpose, an extra length to be turned down and screwed for a securing nut will be found useful; it is faced or parted off when no longer required.

While still set up, the centre can be drilled and bored to a tight push fit on the engine shaft, and the rear extension turned parallel to an easy running fit in the bore of the timing endplate. This bore is not intended to constitute a bearing, but it serves to prevent the escape of oil, and the spiral oilway as specified on the drawing will be found very effective in this respect. The "hand" of the spiral must, of course, depend on the direction of engine rotation, and as the popular arrangement is anti-clockwise at the flywheel end, a right-hand spiral is appropriate. An ordinary vee thread point tool can be used, and the depth of the groove does not need to be more than about ten thous. As one of my north country friends remarked: "It's nobbut a scrat!" but it does the job all right.

The collet is split four ways, either by hand or by using a small circular slitting-saw, and holes are drilled at the ends of the cuts to increase flexibility. Into one of these holes, an internal keyway is cut from the inner end, the object of which is to locate the collet on the shaft, and prevent the possibility of getting the oil entry holes in the two parts out of line. Methods of cutting internal keyways have been described, by myself and others, several times in THE MODEL ENGINEER, and a little job of this kind presents no difficulty whatever, apart from making a suitable slotting tool. The best way to hold the collet for this operation is to insert it in the bore of the flywheel, with a short piece of $\frac{3}{8}$-in. rod in the split end to



prevent it closing in under end pressure.

The collet can be case-hardened without risk of distortion if it is fitted to a 3/8-in. rod, which will also prevent the bore from the hardening compound, so that it is left soft. Quench out by plunging vertically into a vessel of water which has been vigorously stirred to produce a vortex in the centre.

Connecting-rod

I do not propose to describe the operations on what may be termed the "conventional" working parts in any great detail as they have been dealt with so many times before in connection with both four-stroke and two-stroke engines. There is a fairly wide choice of materials for the connecting-rod, but for the most efficient performance, lightness with strength are important considerations. Castings in both bronze and light alloy have been used with success in my earlier engines, but it is worth while to machine the rod from duralumin or other high-tensile light alloy if really high speed is required.

For boring the eyes of the rod, any of the methods which have been described to ensure exact parallelism may be used. Bushing of the eyes is generally accepted as unnecessary in small engines, especially as the bushes may do more harm than good by working loose or shifting sufficiently to block off oilways. If the crankshaft is not drilled as specified for continuous lubrication, an oil hole is drilled in the underside (*not* the top) of the big-end eye so that oil can enter at the point of lowest pressure. A wide slot is best at the little-end, as lubrication is mostly by oil mist.

Piston

Here, again, it is not necessary to give a great deal of detailed information on machining. I always recommend roughing down the outside to within a few thousandths of finished size, then boring the gudgeon-pin hole, and using a temporary cross-pin to hold the piston on a spigot jig for final finishing, including the ring grooves. The dimensions on the drawing include the diameters of the skirt and the top land, to give sufficient working clearance; from the top to the gudgeon-pin, the increase may be in the form of a slight taper, leaving the remainder parallel.

The gudgeon-pin is of the floating type, but should fit fairly tightly in the piston bosses, and end pads are fitted to prevent risk of damage to the cylinder walls in the event of endwise movement.

"To Err is Human—!"

One of the things a technical author quickly learns is that while he may do a thousand things right without any apparent reaction, he has but to make a single slip to bring the whole firmament down on his unfortunate head. In the illustration on the cover of the March 10th issue, showing a section of the 10 c.c. engine, the most meticulous care was taken to ensure that the internal working parts were depicted as accurately as possible, but due to an unfortunate error, one of the most obvious components, the gudgeon-pin, was shown in the wrong plane. As a result I have been inundated with letters, telephone calls, even telegrams—some querulous, some satirical, some facetious.

Here is a sample in rhyme, from Mr. Anthony Beaumont, of King's Lynn:

"Edgar's little four-stroke,
Sparking-plug aglow,
Wouldn't turn a fraction—
Something's seized below.
Let's take out the piston,
Gudgeon-pin as well;
A right-angle of error!
Well—I'll go to—— ! !"

Some readers, however, appear to be gluttons for punishment, and are asking for more explanatory pictures of this type. I will see what I can do about it as soon as I am released from the penance cell and allowed to shed my sackcloth and ashes!

(To be continued)

TWIN SISTERS

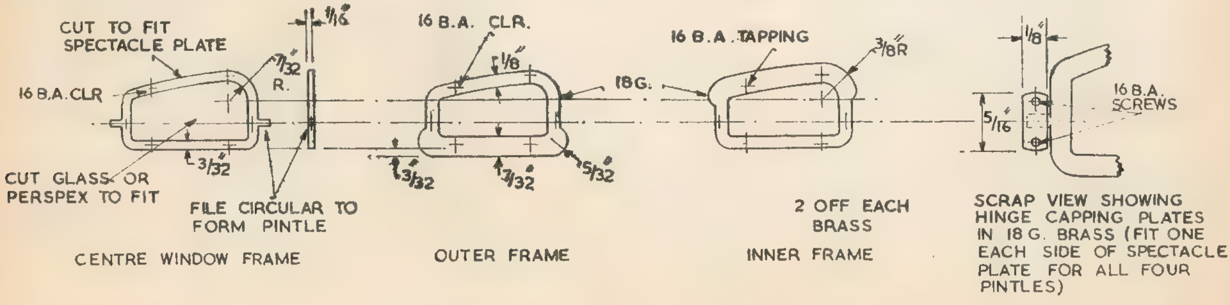
(*Continued from page* 386)

really know what you are doing; the makers will tell you that. A properly ground tool will stand a tremendous amount of abuse, even on a small and slender (or well-worn) lathe, but it won't do the impossible.

A well-ground, properly hardened and tempered, cast-steel tool will cut better and cleaner than most other tools, but it simply will not stand up to high temperatures created by rubbing or excessive turning speeds. For jobs like screw-cutting or any operation where turning speed is necessarily slow, then use cast-steel (or silver-steel, the same thing really) every time. In all these things, one approaches the problem either with a preconceived prejudice or with an open-mindedness which entails a readiness to learn; I belong to the latter class. If ever I make a mess of a job or a machining operation (which I do quite frequently, but am not too proud to admit it) then I first blame myself if the failure is not too obviously a fault in the tool or the machine. Most of the commercial tools and appliances on the market these days, are severely tested long before the user (or abuser) gets hold of them. It is in the interests of the manufacturer to adopt such procedure in his own interests, for he is the last person to invite criticism for his products, especially in the highly competitive world of machines and tools as it is today.

If ever you are faced with a real trouble in the form of cutting tools, their grinding, their setting or their best cutting speeds or feeds, then drop a line to the manufacturer himself. You will find he is a most helpful fellow, and will probably fit you up with all the tables, pretty pictures and information on the subject you are ever likely to need—and right up-to-date, too!

(To be continued)



An Adjustable Off-set Tailstock Centre

ALTHOUGH most small lathes are provided with a means of setting over the upper portion of the tailstock assembly, for the purpose of machining a taper on work mounted between the lathe centres, the advantage of this is, to some extent, offset by the difficulty that may be experienced in resetting the tailstock for exact parallel turning and boring. Personally, we are rather prejudiced in favour of leaving the feed-levers recently by hand-feeding proved rather irksome and, moreover, the finish left on the work is usually not as good as when the automatic traverse is employed.

It was, therefore, decided to make an attachment for off-setting the actual tailstock centre, so that the power traverse could be used and the tailstock left undisturbed.

Nevertheless, it must be remembered

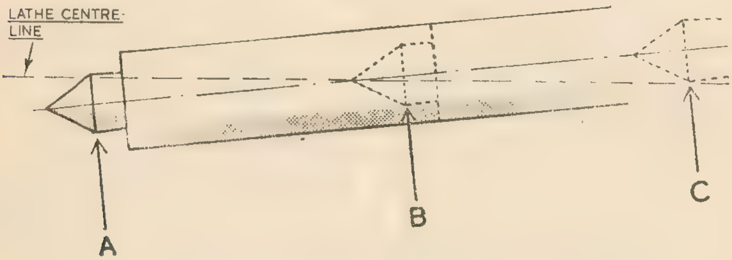


Fig. 1. Showing the effect of the tailstock being out of axial alignment

tailstock well alone once it has been accurately set.

It must also be borne in mind that, owing to indifferent workmanship, there may be some slight slackness in the sliding joint between the upper and lower portions of the tailstock assembly, with the result that, as represented at *B* in Fig. 1, the tailstock centre will be in true alignment in only one position of the barrel.

To ensure that the tailstock is set parallel with the lathe axis, it is, therefore, necessary, as shown in Fig. 2, to take readings with the test indicator against the tailstock centre, both in the extended and retracted positions of the barrel.

The tailstock will be correctly set only when these two series of readings are identical at all points on the circumference of the centre, and provided, of course, that the lathe headstock bearings are in good order. As will be realised, this may well be a somewhat tedious and time-wasting performance, and one which there is little encouragement to repeat once it has been carefully carried out.

It follows, therefore, that, rather than interfere with the tailstock setting, taper turning is more often carried out by setting over the topslide and feeding the tool by hand.

However, machining a set of tapered

that, when either the tailstock centre or the tailstock itself is offset, the two lathe centres will be out of axial alignment and, as a consequence, uneven wear may take place in the drilled centre hole at the tailstock end of the work. Although this may be of little importance when turning feed-levers, having a taper of some 2 deg., it may result in inaccurate workmanship when machining parts with a steep taper.

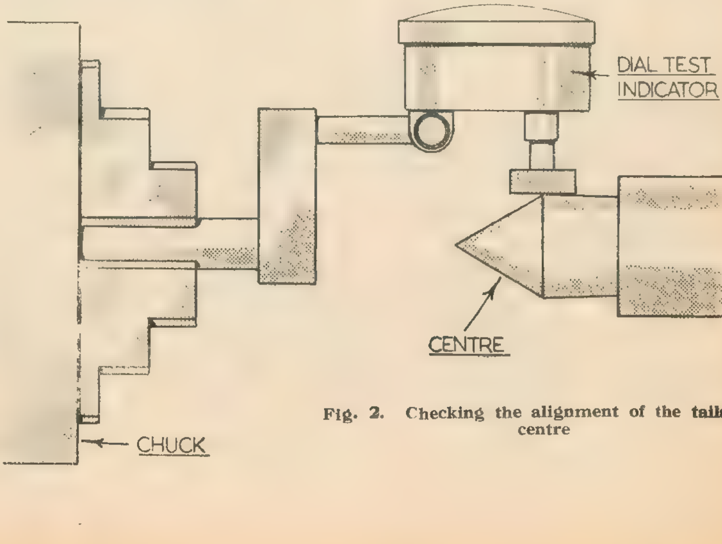


Fig. 2. Checking the alignment of the tailstock centre

Making the Tailstock Attachment

The tailstock fitting, illustrated in Fig. 3, has a range of movement of $\frac{3}{16}$ in., either towards or away from the operator, so that work can be turned tapering in either direction.

The base *A* was machined in the shaping machine, but this work can be done equally well by a milling operation in the lathe.

The undercutting to form the slideway need be no more than $\frac{1}{16}$ in. deep, and the two slots should be made wide enough to allow clearance for the clamping-screws.

After the part has been secured to the lathe faceplate, it is bored and screwcut, or accurately tapped, to receive the shouldered end of the Morse taper arbor, and the first thread is bored out to ensure that the arbor will screw fully home. One side of the base is drilled and tapped for the 2 B.A. Allen grubscrew that secures the arbor in place.

The Morse Taper Arbor B

A piece of $\frac{1}{2}$ in. dia. mild-steel was cut to length and then set to run truly in the four-jaw chuck for centre-drilling, and afterwards screwcutting, one end to the dimensions given in the drawing.

The work was next reversed in the chuck, to enable the other end to be reduced in diameter, and then centre-drilled and tapped 2 B.A.

Note that the countersink formed must be larger in diameter than the hole formed by the clearing-size drill, which is used to remove the end threads ;

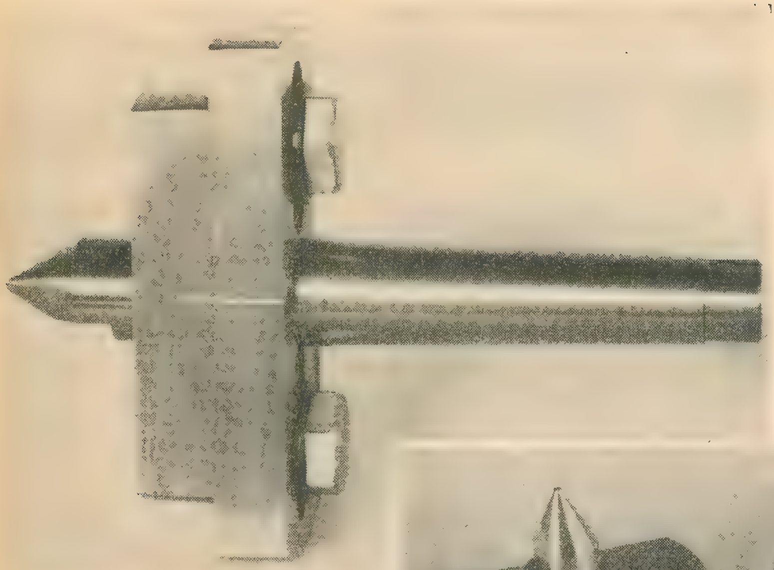


Fig. 3. The finished tailstock attachment

for the part will now have to be mounted between centres for forming the taper to fit the tailstock barrel.

As represented in Fig. 6, a convenient and reliable method of setting the lathe topslide to the exact taper required is to make use of a standard lathe centre of corresponding taper as a guide.

Grip a short length of steel rod in the chuck and, after facing the end, form a centre with a centre-drill. Next, mount a lathe centre between the female centre so-formed and the tailstock centre.

Fit the test indicator with a flat-faced anvil, and mount it on the topslide, using, perhaps, one of the three types of holders described in previous articles.

The angularity of the topslide is now adjusted until the reading of the test indicator remains unaltered as it is traversed from end to end of the Morse taper guide.

When machining the taper on the arbor, mounted between the lathe centres, it is important to set the cutting edge of the tool at exactly centre height; otherwise, the resulting taper will be formed with a curved contour. Run the lathe at high speed and maintain as even a hand feed as possible. Although it is hardly necessary to check the taper if it has been carefully machined, this can be done by drawing a series of pencil lines along the arbor, and then engaging it in the tailstock barrel with a twisting motion; if the taper is accurate, the pencil lines will be obliterated throughout their length.

It should be noted that two spanner flats are formed on the small end of the arbor to enable it to be screwed firmly into place in the body part.

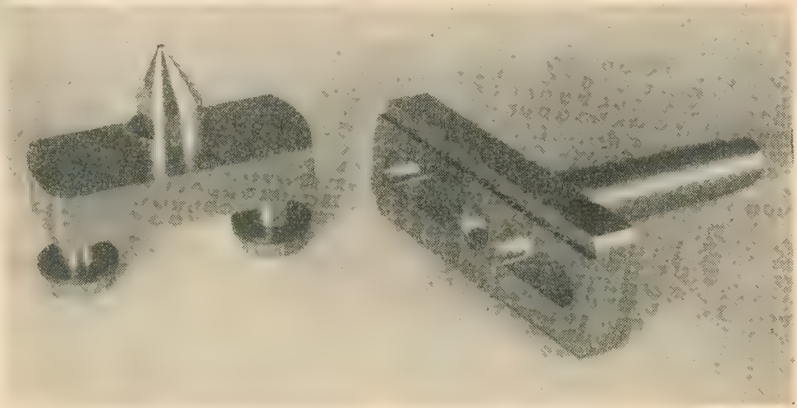


Fig. 4. Showing the parts of the adjustable tailstock centre

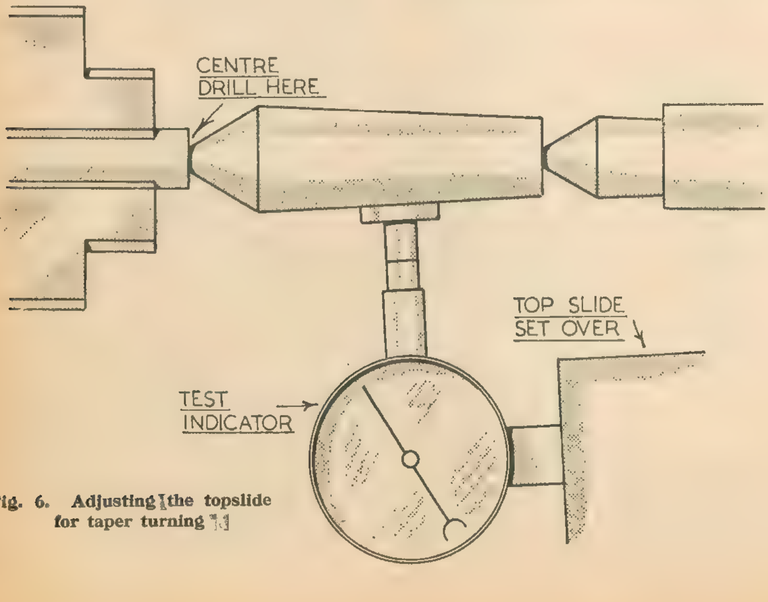


Fig. 6. Adjusting the topslide for taper turning

The Sliding Member C

This part is also machined in the shaping machine or milled in the lathe to a close sliding-fit on the body. After the two clamping screws have been fitted, the two parts are firmly secured together in the central position, so that the assembly can be mounted in the tailstock for drilling the slide with a centre-drill gripped in the chuck.

Before dismantling the parts, a line should be engraved across the upper surface of both the slide and the body to indicate the central setting. The slide can now be drilled and tapped, or bored and screwcut in the lathe, for mounting the work centre.

The Work Centre

This fitting is best made of silver-steel and hardened and tempered after being machined. A length of $\frac{1}{2}$ in. diameter rod is set to run truly in the four-jaw chuck, and a light cut is taken along the work to ensure circularity and parallelism.

The end is next shouldered down and then threaded $\frac{5}{16}$ in. $\times$ 26 t.p.i. After the centre has been parted off to length, it is reversed in the chuck, and again centred, for machining the 60 deg. coned point with the topslide set over to 30 deg. As this is a working centre,

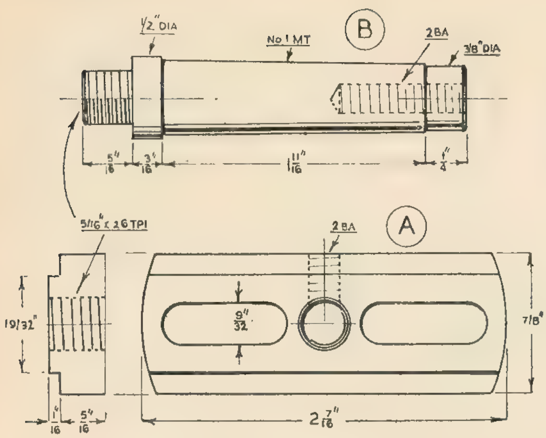


Fig. 5. The base of the attachment—A; and the Morse taper arbor—B

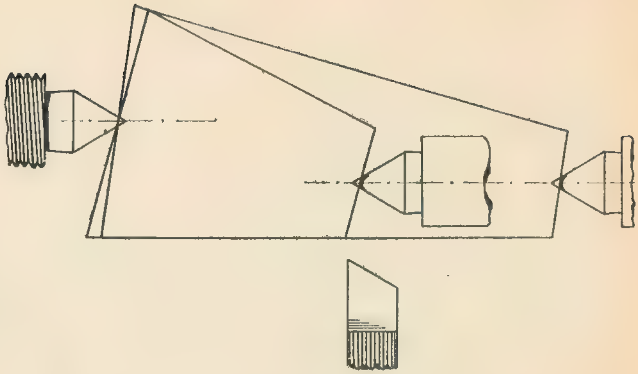


Fig. 9. Showing how the angle of taper varies with distance between the centres

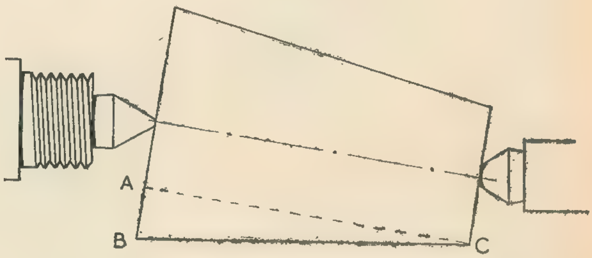


Fig. 10. Calculating the amount of set-over for machining a taper of known angle

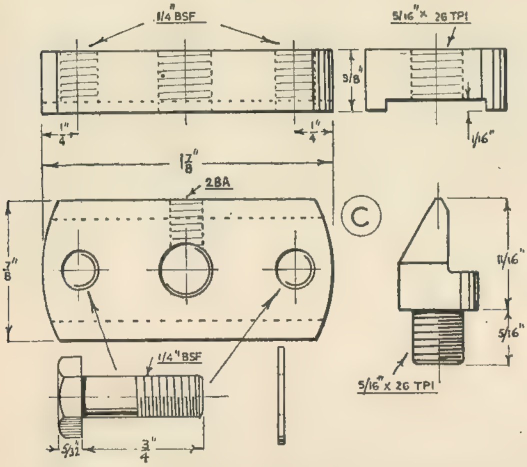


Fig. 7. The slide with its coned centre and clamping-screws

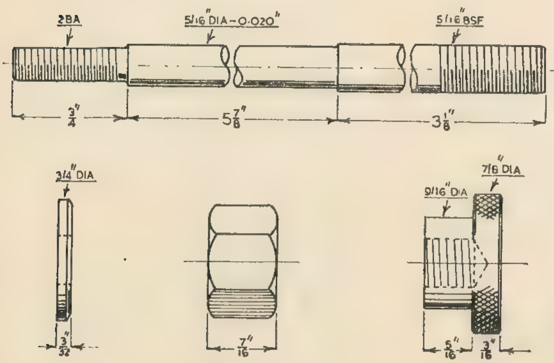


Fig. 8. The draw-rod

it should be carefully polished with an emery stick and, before hardening, a flat is either filed or shaped on the near side of the centre, to enable a lathe tool to machine work of small diameter.

However, before starting to form the flat, screw the centre into place and mark its position accordingly. In order to secure the arbor and the coned centre in place, an Allen grub-screw is fitted to the underside of both the slide and the base.

The Draw-Rod

As the new centre has increased overhand and, when off-set, tends to be rotated by the cutting pressure of the tool, it is advisable to secure the arbor in the tailstock barrel by means of a draw-rod, engaging in the threaded hole previously formed.

The draw-rod shown in the drawing was made for use with a Cowell rack-feed tailstock barrel, and it is reduced in diameter for part of its length, in order to give a working clearance in the unlikely event of the barrel not being drilled exactly concentric with the tapered seating.

In use, the rod is first screwed home in the end of the arbor, and, after the tailstock fitting has been set horizontally, the hexagon nut is tightened to secure the arbor in place.

Slackening the nut and then tapping lightly on the end of the draw-rod will eject the arbor.

Setting over the Tailstock Centre

It is not possible to graduate the slide in order to indicate the amount of off-set required for any particular degree of taper; for, as represented in Fig. 9, this varies with the actual length of the work-piece.

Where the set-over remains constant, the degree of taper formed will increase as the two centres come closer together. and this militates against adopting the method illustrated in Fig. 6 for adjusting the set-over of the tailstock centre.

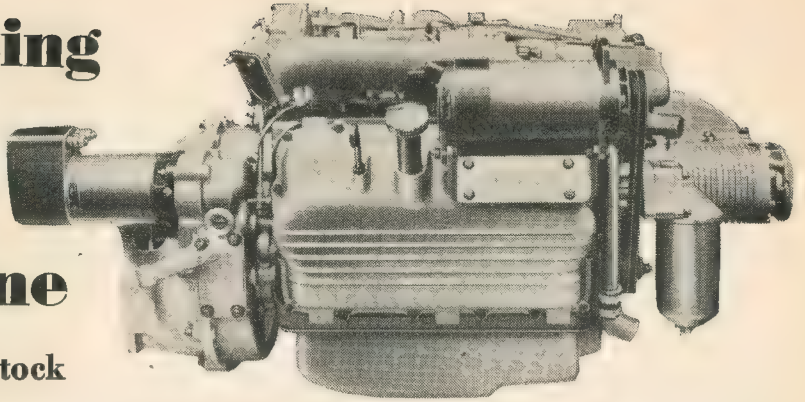
No. 1 Morse taper has a total, included taper of 0.05 in. per inch of length; that is to say, the half-taper, with which we are concerned for machining purposes, amounts to 0.025 in. per inch.

If the length of the part is 3 in., the tailstock centre will then have to be set over towards the operator for a distance of 0.075 in. The latter distance can be accurately measured by mounting the test indicator on the topslide, and then setting the dial to zero after the plunger has been brought into contact with the slide of the attachment. The adjustable centre is now moved until the test

(*Continued on next page*)

An Interesting New High-speed Diesel Engine

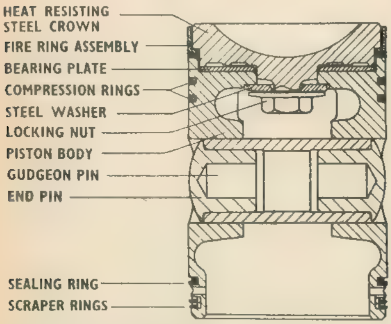
By J. D. McLintock



Side view of the new Commer diesel engine, a direct injection two-stroke of the opposed piston type, with blower-assisted scavenging

It is a curious thing that whilst, in general, commercial-vehicle design is restrained by tradition—and is, indeed, conservative in the extreme—its progress is occasionally punctuated by decidedly extra-normal conceptions.

Such have been the occasional use of steam power, the petrol-electric layout, the petrol two-stroke (Trojan, for example), the early overhead valve engines, the two-stroke diesel (e.g. Foden), etc., against the conventional background of simple side-valve, and later o.h.v., engines and four-five or six-cylindered oil engines of classic design. Ahead lies another technical "outcrop," no doubt, in the use of the gas turbine engine, whilst the current extra-normal phase takes the form of a spate of comparatively small, high-speed oil engines, some being of such comparatively modest dimensions as to be effectively useable in London taxicabs.



The special design of hot crown piston causes fuel to burn immediately it enters the combustion chamber, and to continue burning evenly through the complete injection period

Quite the most interesting of these light diesels so far appears to be the new Commer supercharged two-stroke. This is a three-cylindered unit with six pistons. That seemingly incompatible arrangement is made possible by virtue of the opposed-piston system which is employed. In other words, there are three horizontal crosswise cylinders, each having two pistons *between* which combustion takes place.

This makes for a flat, shallow engine (not unreminiscent, in that respect, of some historic petrol engines) and intended, in this case, for convenient housing under the floor of a coach.

Perhaps the most interesting thing about the engine, however, is the arrangement used to convert the reciprocating motion of the pistons into the rotary motion required for transmission. In effect, the motion goes through 180 degrees—or through two right angles, if one prefers it that way. This is made possible by the employment of two sets of connecting-rods, one rod being attached to the piston (small-end) and the other to the crankshaft (big-end) with their respective "free" ends attached to a common rocking lever. Many will be tempted to argue that this represents undue complication, in that there are three moving parts instead of one, for each piston, but they should bear in mind the importance of other factors arising from comparative angularity, or lack of angularity, if one cares to phrase it in such a way. Clearly, for example, there is reduced side-thrust on the pistons, with consequent reduction of cylinder-bore wear, whilst mechanical stresses are likely to be at a minimum, and vibration very slight.

The common crankshaft lies centrally below the cylinders, which are formed in a single compact iron casting with renewable wet liners. The integral crankcase block supports the four white-metal-lined thin-wall main bearings, this type of bearing being also used for the big-ends, but the top halves being copper-lead-indium lined.

The cylinders have inlet ports at one end and exhaust ports at the other. Single-hole injectors are supplied from a C.A.V. pump unit. A Roots-type blower is chain-driven from the rear end of the crankshaft and supplies air at low pressure to the air-chest in the main casting, through an oil-bath air filter and silencer. A state of vacuum in the main body of the crankcase prevents possible leakage through oil seals and joints.

Bore and stroke are respectively $3\frac{1}{4}$ in. and 4 in., giving a swept volume of 199 cu. in. (3,261 c.c.) and this unusual design develops 90 b.h.p. at its maximum governed speed of 2,400 r.p.m., the maximum torque of 250 lb./ft. occurring at 1,200 r.p.m.

Apart from its convenient shape, various advantages are claimed for the unit, including high thermal efficiency (due to the absence of cylinder-heads) and the usual stated advantages of the two-stroke cycle. It is also stated that this type of unit is easy to maintain, as there are no valves or valve gear, and only three sets of fuel delivery and injection units.

IN THE WORKSHOP

(*Continued from previous page*)

indicator records 75 thou. in., and the slide is then firmly clamped. As the exact points of engagement between the work centres and the lathe centres can hardly be precisely measured, a readjustment may have to be made, by the same means, during machining in order to turn the taper to an exact fit.

Where the included angle of the taper is alone specified, only half this figure must be taken into account for calculating the set-over needed. The required angle is that represented by ACB in Fig. 10, and the ratio of the lengths of the sides AB to AC is equivalent to the tangent of the angle ACB.

Where this angle is one of, say, 3 deg., and AC measures 3 in., then $\frac{AB}{AC}$ = tan. 3 deg. or 0.0524 in.

Accordingly, $\frac{AB}{3} = 0.0524$ in., and $AB = 0.1572$ in., so the tailstock centre is set over for the latter distance.

L.B.S.C.'s "Netta"

HOW TO ASSEMBLE THE $2\frac{1}{2}$-in. GAUGE BOILER

CARRYING straight on as promised last week the next stage is to fix the tubes in the firebox and then do what the kiddies would call "put the inside in the outside." As this set of tubes can all be silver-soldered at one fell swoop, insert them in the holes in the firebox tubeplate, in which they should fit tightly, letting them project through about 1/32 in. Now put the smokebox tubeplate temporarily on the other end, say about $\frac{1}{16}$ in. or so down, and carefully line up all the nest of tubes, so that they are parallel to the sides of the firebox, and at right-angles to the firebox tubeplate. To fix them, use either best-grade silver-solder, which is two parts silver to one of brass (sometimes called No. 1 grade by the trade) with either Boron compo, or powdered borax, as flux; or Easyflo, and the special flux sold for use with it, either flux being mixed to a creamy paste with water. Smear a good dose of this, all around the tube ends, where they enter the tubeplate.

Now another warning to beginners; if you are one of the lucky gang who own, or have the use of, oxy-acetylene apparatus, *don't* use it for the tube job. Never mind what Mr. I. Knowitall or anybody else tells you; just play for safety. I've built enough boilers, goodness only knows, to be able to give reliable advice, and I always "take my own medicine," in a manner of speaking. I have in hand at the present moment, the boiler for an experimental 2-6-2 in $3\frac{1}{2}$-in. gauge; and now my damaged wrist has recovered sufficiently to support the weight of a blowlamp, I'm using same to silver-solder the tubes into the firebox. The job needs a mild diffused flame, such as only a blowlamp, or air-gas blowpipe can supply; a very hot, concentrated flame will burn the thin metal of the tubes, and even if no holes show, the job will be unsafe, and you might as well pitch the whole lot in the domestic ashbin, for all the use it would be as a boiler.

Stand the firebox-and-tube assembly in the pan of coke, with the tubes pointing skywards, piling up the coke inside and outside the firebox; it should reach to within about 1 in. of the tubeplate inside. Now direct your blowlamp flame on the tubeplate and firebox, and *not* on the tubes, heating up the end of the firebox first. When it glows dull red, and the coke is also red-hot, direct the flame partly inside the firebox, and partly outside, letting it lick at the tubes, gradually heating them to red. When the whole issue has become medium red, and the flux has fused, touch each tube with the strip of silver-solder (the strips that I use, are $\frac{3}{16}$ in. wide and about 20-gauge) and if the heat is right, a little will melt off, and "flash" right around the tube, lying in a nice even fillet. Do the big tube last; then once more direct the flame partly inside the firebox, which will assist the silver-solder to "sweat" right through the joints. If all's well, you will see a silvery ring showing around each tube end, inside the firebox. Let cool to black, then carefully remove the smokebox tubeplate, and heat up the ends of the tubes to dull red, which will soften them for expanding purposes. Quench the assembly in the pickle-bath, wash off well and clean up.

Fitting Firebox to Shell

Beginners should always bear in mind that *clean* joints are absolutely essential for *sound* joints, so clean the inside of the firebox wrapper at the top,

Dr. J. H Greenway's L.B. & S.C.R. "rebuilt Vulcan" brings back memories

She looks bigger than 1½-in. gauge!

inside of throatplate at bottom, inside end of barrel, tops of crownstay flanges, and around bottom of firebox. Cut a piece of $\frac{3}{16}$-in. square copper rod to a length that will fit tightly between the throatplate flanges at the bottom, cleaning it well and rounding off one sharp corner at each end, so that it beds well home when jammed in position. Turn the boiler shell upside down and slide the firebox-and-tube assembly into it until the front end of the firebox butts up against the bit of copper rod between the throatplate flanges. The crownstay flanges should be resting against the top of the wrapper. Set firebox centrally between sides of wrapper and put a toolmakers' cramp over throatplate and firebox, gripping the bit of copper rod tightly between them. Put another cramp over the end of each crownstay, to hold them tightly against the top of wrapper. Now put three $\frac{1}{16}$-in. copper rivets clean through throatplate, square rod and bottom of firebox tubeplate, drilling the holes with No. 51 drill.

The crownstay flanges can then be riveted to the wrapper. Scribe a line on the outside of the wrapper, directly over the centre of each flange, and drill No. 51 holes at ½ in. centres, removing any burrs. The rivets are easily inserted from the inside, by the help of a strip of metal about $\frac{3}{16}$ in. wide, with a nick in the end like a distant signal. Jam the rivet in the nick, insert in hole, and pull away the strip. To support the rivet while hammering down the shank, put a bit of metal in the bench vice, about $\frac{3}{16}$ in. × 1 in. section, with about 4 in. projecting from the side. The boiler can be slipped over this, with the rivet-head resting on it, and the shank hammered down with ease. If the support slips—see last week for the remedy!

Next insert the smokebox tubeplate, flange first, and make sure that the vertical centre-line of this, coincides with the centre-line of the boiler, otherwise, the tubes won't line up with the holes. Tap it down until it just touches the tubes, then line up each tube with its corresponding hole, with a wooden skewer or pencil, finally tapping the tubeplate further down until each tube stands out about 1/32 in. from the plate. The tubes can then be expanded into the holes by driving a taper drift into each; this is just a bit of steel rod with the end tapered and polished. The shank of a worn or broken drill does fine. Grease it, insert into tube end and gently drive with a hammer until the tube is expanded tightly into the hole. If it sticks, a side tap will usually free it.

Another Warm Job!

Either brazing strip or coarse-grade silver-solder can be used to fix the smokebox tubeplate, and best grade or Easyflo for the tubes. The easiest way I know of doing the job is to get a big tin lid, or old discarded tray, and cut a hole in it, large enough to let the boiler barrel pass through. Stand the boiler assembly on end, barrel upwards, and put the "holey" tray over it, about halfway down; then prop up the tray so that it stays in that position, with a couple of bricks, or anything else that may be handy. Pile some coke around the barrel, to the height of the tubeplate, and put a wad of asbestos flock or string, in each tube end, to protect same from burning. Put a good dose of wet flux all around the joint between smokebox and barrel and around all the tube ends. First heat up the barrel and the coke around it, until the coke glows bright red; then concentrate the flame on a part of the circumference, away from the tubes. When this glows bright red, apply your brazing strip or coarse silver-solder in the flame and melt off a little into the joint; then slowly work the flame all around until you get back to the starting-point, letting enough brazing material run in to form a fillet.

By this time, the whole tubeplate will be well and truly hot, and the flame can then be directed on the tube ends. They won't burn, with the asbestos inside, and the tubeplate outside. When they reach a dull red heat, apply the silver-solder or Easyflo, to each one, in the flame and a fillet will flash around each, as it did at the firebox end. Give a final blow, to sweat the silver-solder through, then prepare for quick action. Take the tray off and remove the bricks, as quickly as you can, then lay the boiler, firebox upwards, in the pan, with the firebox wrapper overhanging the edge. Put one of the bricks on the barrel, to prevent the whole lot from tipping up. If you haven't already put any flux along the crownstay flanges, do so now (I usually put some flux on the joints when assembling, and another lot before setting up the job in the brazing pan) lay a strip of coarse-grade silver-solder in the joint between flange and wrapper, on the outside of the flanges, and heat up by directing the flame partly inside and partly outside When it approaches dull red, and the flux has fused, blow directly on the wrapper sheet from the underside; that is, what would be the top, if the boiler were right way up. The blowpipe or blowlamp should be going "all out" for this bit, as plenty of heat is required. As soon as the wrapper gets to a bright red, the silver-solder strip will melt, and flow in between flange and wrapper, sealing all rivets; while it is molten, add a bit extra for luck, still keeping up the heat. When it has penetrated right through, which can easily be seen, let the job cool to black, quench out in the pickle (mind the splashes!) wash off and clean up.

Final Stage of Assembly

Fit the backhead next; measure from top of wrapper to fire-hole ring, transfer measurement to backhead, and cut the hole, leaving it undersize. Try in place, and file hole where needed, so that the lip of the firehole will go through when the backhead is in place. Beat down the lip, outwards and down, same as on the firebox side; then hold the wrapper tightly against the backhead flange and fix it with little bits of screwed copper wire, running through tapped holes in wrapper sheet and flange. Drill No. 48 and tap 3/32 in. or 7 B.A., screwing wire to suit, and spacing at about ¾ in. centres. Fill in the spaces between firebox, wrapper sides and backhead, with bits of clean $\frac{3}{16}$-in. square copper rod, cut to fit closely, and riveted in place by $\frac{1}{16}$-in. copper rivets going through the lot. The dome and safety-valve bush holes can then be cut in the top of the boiler, and the bushes fitted; these should preferably be of copper (I make mine from slices of thick copper tube) but bronze or gunmetal will do. Don't use brass, or "screw-rod"; the latter, especially, is liable to melt or distort under the heat, when brazing or silver-soldering.

Beginners should also bear in mind that one of the secrets of clean and sound brazing and silver-soldering, is to have the job heated sufficiently to allow the jointing material to flow

freely; and it is essential that this rule is strictly observed in the final job of sealing up the backhead and foundation ring. Lay the boiler on its back in the pan of coke and pile it up well around the firebox, to the level of the foundation ring. To prevent the flame of the blowlamp getting at the tube ends and cracking the silver-soldering, either fill the firebox with asbestos cubes, or put some bits of asbestos millboard over the tube ends. The backhead joint, bushes and foundation ring should be well covered with wet flux. There is no objection to using silver-solder for the whole of the final job, provided that the builder doesn't mind the expense; silver-solder costs muckle bawbees the noo, ye ken, but *don't* use an oxy-acetylene blowpipe, and *don't* use any so-called silver-solder that has a phosphorus content. You can take that as gospel, from your humble servant, who has actually built many more boilers than anyone who says otherwise; I have never had a failure. I'll describe the oxy-acetylene process, plus my old pal Sifbronze, when dealing with the $3\frac{1}{2}$ in. and 5 in. boilers.

The actual job is simple. With the blowlamp going "all out," heat up all around the foundation ring until the surrounding coke begins to glow red; then concentrate on one corner and when that reaches bright red, dip the end of the strip of brazing material, or silver-solder, in the flux, and apply it to the metal in the flame. If the heat is right, it will melt off at the end, and run into the joint like water. Move the flame very slowly, feeding in the jointing metal as you go; keep dipping the end in the flux. It is merely a question of time and patience, to go clean (in more senses than one!) around the four sides and arrive back at the starting-point. Next, sharp's the word and quick's the action, as the sergeant would say. Grab the boiler with the tongs, holding it at the backhead end of the firebox, and up-end it in the pan, backhead upwards. The whole doings is already mighty hot, so you can start blowing at the bottom corner of the backhead right away; and as soon as it glows red, apply the strip of silver-solder. Work slowly around, as before; then go around the flange of the firehole, with best-grade silver-solder or Easyflo, and plenty of flux. Lastly, stand the boiler right way up, and run a little best-grade silver-solder or Easyflo around the dome and safety valve bushes, blowing the flame directly on them. When the whole lot has cooled to black, it can be carefully lowered into the acid-pickle by aid of the garden rake or clothes-prop, to avoid any splashes on your clothes or skin. Leave it in for 20 minutes or so, then fish it out, again avoiding drips; drain all the pickle from the inside and wash well in running water. The good lady won't object to washing off the boiler in the domestic sink, as the pickle will remove stains and leave the sink clean and bright; it does ours, anyway!

I have dilated somewhat on the above job, as quite a number of new readers have joined our craft since I last went into details of boiler-smithing, and they have requested information, having no back numbers to which they can refer. There will be no need for detailed repetition in the construction of the two larger boilers; but as mentioned above, and all being well, I will give some hints on using both oxy-coal and oxy-acetylene blowpipes, both for ordinary brazing and bronze-welding. The boiler can be given a rough test for tightness, by plugging all the holes except the safety-valve bush, and making an adapter for that, to accommodate a tyre pump. If the boiler is then put in a pail of water, and about 20 lb. of air pumped in, any leakage will be indicated by a stream of bubbles, like a puncture in a motor tyre tube. There is no need to reheat the boiler to stop up a "pinhole," such as is caused by an undetected borax bubble; just drill a No. 55 hole, tap it 10 B.A. and screw in a stub of screwed copper wire, with a taste of plumbers' jointing on the threads. File off all the now-unwanted rivet heads, under the barrel, and at bottom of firebox, and the boiler is then ready for staying.

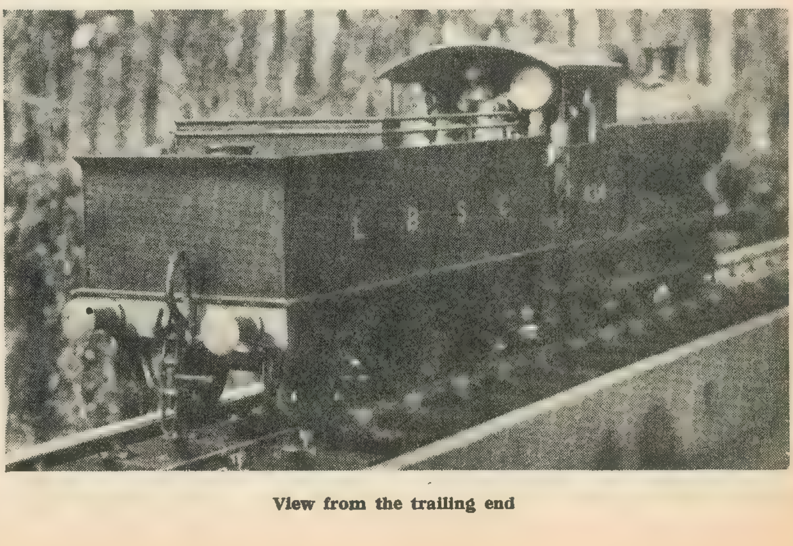
A Saucy Little Minx!

The reproduced photographs of a $1\frac{3}{4}$-in. gauge rebuilt Vulcan goods engine will surely gladden the hearts of all who loved the old "Brighton." She was built by Dr. J. H. Greenway, who has a fine "scenic" line at his home at Bognor Regis. At time of writing, I have no details of her, except that she has a spirit-fired water-tube boiler, and can make a long non-stop run with a train 20 ft. long, a tidy load on that gauge. The various views show that she is complete in all details; but I'll bet our old nighthorse Inspector Meticulous will raise a moan about the cab windows, saying that they should have been larger, higher up, and rimless. The windows on big sister—I knew her well—were entirely inside the cab, and opened inwards; but that's only a minor detail not worth losing any sleep over. Our medical friend deserves congratulations; he certainly gave me a tonic by sending the pictures!

Don't You Believe It!

As there has already been some editorial and other comment on the accounts in the daily Press, about the impending "doom" of the steam locomotive, and its replacement by diesel propulsion, maybe I can be allowed to say my little piece on the subject. The daily Press folk invariably ignore facts when they wish to create a sensation—that is their business!—and when they get down to technicalities, they are absolutely and completely sunk; recollect the statement that by leaving off the running-boards of the Southern Q1 class, there was a saving of 20 *tons* in the weight of the engine? Well, let's face a few *facts*.

A modern diesel-electric locomotive —which is really an electric locomotive carrying its own power-station—costs far more to build, maintain, and run, than a steam locomotive; in this country, at any rate, where its fuel has to be imported. Loud cheers from the oil companies. Such a complicated box of tricks is far more liable to fail, and needs a skilled staff trained in internal-combustion and electrical apparatus, to keep it on the road. Its much-vaunted "immediate availability" does not always work out that way, as it often emulates its little relations at the boat pond and elsewhere. Whatever extra power of acceleration it may possess, offers little advantage on ordinary main-line work; for example, a Scottish express stopping only at York and Newcastle, or Crewe and Carlisle. Its exhaust fumes are poisonous.



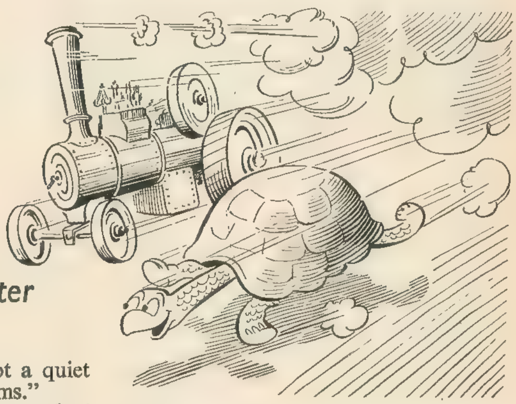
View from the trailing end

A modern steam locomotive is a simple straightforward job, much cheaper to build, maintain, and run; and requires no specially-trained staff. It uses home-produced fuel—at least, it *would* do, if the super-crazy idea of selling our best coal abroad, and importing rubbish, were discontinued. Properly maintained, failures are rare (there were very few failures on the old L.B. & S.C.R.) and as to availability, there is a method of steam-raising from all cold, by aid of a stationary boiler, that can have an engine ready for service in an incredibly short space of time, without straining the boiler. A skilled driver can accelerate a train of reasonable weight, on the kind of service mentioned above, in a manner little, if any, inferior to a diesel.

Given improved track and signalling, steam can lick diesel any day in this country; the record of the few diesels so far put into service here, is certainly nothing to write home about, if the full story were told. Steam is inferior only on intensive suburban services where high acceleration and quick turn-around are of the utmost importance; Milly Amp cannot be beaten on that job. She is also ideal for heavily-graded lines, such as the recently-completed Manchester-Sheffield line through the Pennines; incidentally I'd hate to go through Woodhead Tunnel in a train hauled by a couple of diesel units, for fear of being gassed. The electrification of Bromsgrove Lickey is long overdue ! To sum up, in my humble opinion, the future of British Railways could be assured, *not* by substituting diesels for our well-tried and faithful friends (though the manufacturers of diesel equipment, and the oil companies, might be disappointed !) but by electrification of all busy suburban lines, and shorter main lines (like the merry old Southern), improving and re-signalling all the principal main lines, to avoid delay and congestion, and not only building new high-speed steam locomotives (did I hear somebody say " like *Queen Mabel* " ?) but rebuilding existing classes with modern improvements. Now, to whisper in your ear, I'm not the only one who is of that opinion; for without breaking any confidences, I can give you the tip that at least three classes of existing steam locomotives are to be " modernised " (work has already started) in the hope that they will give another 20 years of first-class service.

Had the cash and brains expended on the development of the i.c. engine, been applied to steam, the i.c. road vehicle, both private and commercial, wouldn't be in the position that it is today; unfortunately, taxation killed the steam lorry and tractor. Personally, I'd love to take a steam car of my own design, to the West End of London, and show a few of the taxi-drivers what acceleration really is !

Traction Engine v. Tortoise



By

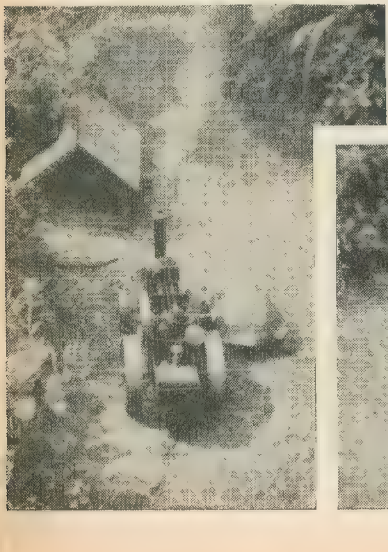
C. E. Gillingwater

THE photographs show the race in progress, the contestants fighting grimly for first place. On account of underhand tactics such as bumping and boring, the tortoise is often disqualified.

The engine is built to the " M.E." one-inch scale drawings with some slight modifications. The gearing on the original was considered too high and reduced to 30 : 1. The steam regulator was altered to a screw thread control.

Firing is by a small home-made Primus with an adjustable jet. It works well on petrol or paraffin, not a quiet burner, but it gives the " therms."

On test, the engine had one bad fault; when running up hill, condensed water collected in the smokebox and would flow back through the tubes, putting out the fire. A small hole drilled in the bottom of the smokebox cured this. With spuds on, the engine can pull a cwt. of cement without jibbing.



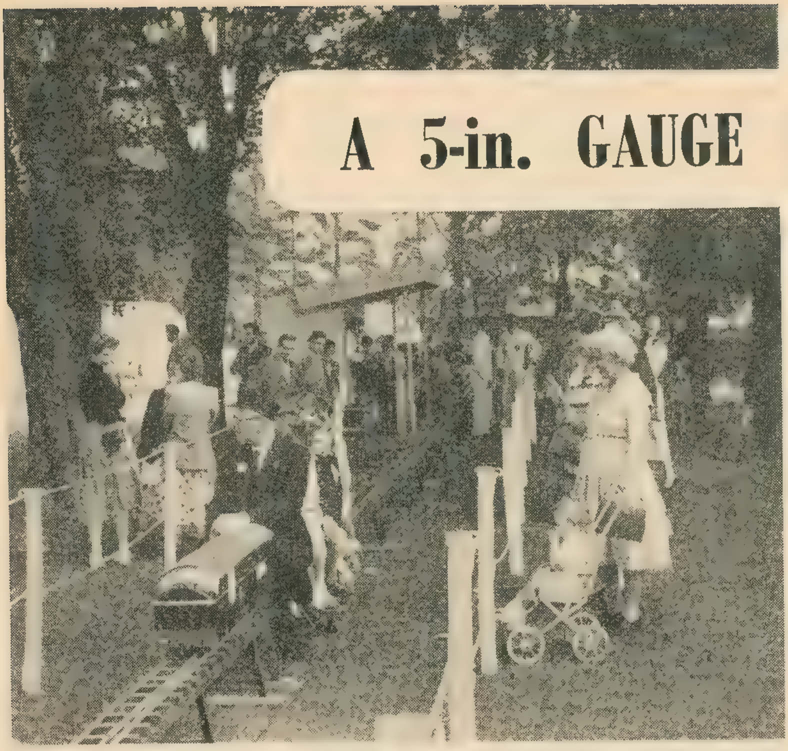
Left: Toby tries a little bumping and boring at 3 m.p.h.

Below: Coming up for a photo-finish—very fast (4 m.p.h.)

The tortoise is, perhaps, forty years old. He roams at will in the garden where he has a small wooden house. On warm days, he is usually asleep on the refuse dump in the sun. The sound of the engine's chuffing, however, soon rouses him and the race is on.

The race, proper, begins on the garden path. The tortoise is simply tearing along and the engine going " all out "; I lock the controls and stand back to watch the fun. The engine gives forth its primus roar, a cloud of steam and the wheels revolve quicker and quicker. Travelling fast, it goes bumping over the uneven surface of the garden path. The tortoise sets his beak grimly, and sprints forward with all his might. On an ordinary day, the engine wins, but if the day be hot, then the reptile wins hands down !

The engine has always attracted the tortoise, perhaps on account of its gay paint, red, green and black with gold trimmings.



A 5-in. GAUGE ELECTRIC LOCO.

By R. R. Turner

A train leaving "Cobdown Halt" on the afternoon of the show

COMMENCING in October, 1953, the Model Engineering Section of Aylesford Paper Mills Sports Club decided to build a passenger-hauling electric locomotive of 1-in. scale. The original suggestion came from the society's chairman, Mr. H. H. Watson, and the electrical engineer to the firm, Mr. C. Severs, both of whom were of the opinion that an engine of this type would be easier to build and run than a steam locomotive. After some considerable opposition from the "live steam" members, a meeting was called to discuss the type to be built. Photographs of various electric and diesel-electric locomotives were obtained, and finally the L.M.S. No. 10,000 diesel-electric was chosen as being the most impressive locomotive of its type. At first, the general arrangement drawings were going to be obtained from Derby Works, where the engine was designed and built, but it was decided that enough details and information of the general outline could be gathered from photographs. In the meantime, one of the members found an illustrated article in a boys' Hobbies magazine describing how to build No. 10,000 in wood and cardboard, with a side elevation and end view in 4-mm. scale. These measurements were scaled up and drawings made, using a scale of 1 in. to 1 ft. In this scale, the overall length is 5 ft. 1½ in. with a width of 9 in. and height from rail to roof is 13 in. The total weight in working order is about 3 cwt.

For the main frame, or chassis, a length of 9 in. channel-iron with 3 in. high sides, was obtained, and rectangular holes, positioned, each side of the bogie pivot positions, cut out with an oxy-acetylene cutter. The purpose of these holes was to allow the motor and reduction gear mounting brackets to be attached direct to the bogies, to be free to move with the latter and yet to be inside the body of the engine.

The bogies consisted of $\frac{5}{16}$-in. bright mild-steel plate, 22 in. long, spaced at either end with ¾-in. square steel stretchers and by a 6 in. long steel bolster in the middle. The axleboxes were of bronze, sliding in horn blocks of angle-iron, riveted to the inside of the frames, and springing was by two strong compression springs located in holes on top of the boxes and bearing up against the reinforced top of the slot. Keep-plates screwed underneath held the boxes in place when the engine was lifted. End plates covered the open axle ends, and a hole on top of the axle-box provided means of lubrication. The weight on the bogies was taken by a brass rubbing plate, 4½ in. in diameter and ¼ in. thick. This rubbing plate was lubricated by drilling several $\frac{3}{16}$ in. holes through the plate and filling with grease.

Consideration was next given to mounting the motors, one in each bogie. Each motor was strapped in a semi-circular wooden cradle secured by longitudinal steel tie-rods to the L-shaped steel end plates which were bolted direct to the bogie frames.

The author at the controls on a test run

Drive, was by an ordinary straight spur wheel and pinion, with one intermediate wheel, to a secondary shaft. To this was keyed an eight-start worm and thence at right-angles by worm wheel, keyed directly to the leading axle, giving a final reduction of 9 to 1. Ball-races were fitted to the intermediate wheel and the spur wheel, and also to the ends of the worm shaft, the latter being housed in brackets bolted to the bogie stretchers.

The next stage was construction of the bodywork. With the kind permission of Mr. R. Robertson, Head of the Education Department and Works Training School, work was commenced. Under the supervision of the woodwork master, two of the carpentry apprentices carried out the complete construction. Two long pieces of plywood formed the sides of the body which were screwed to solid nose and driving compartments at each end. These long side panels were secured at 9-in. intervals to hollow bulkhead-type frames which, in turn, were screwed to the steel walls of the channel iron chassis. The curved wooden roof top was made in three removable sections, the two ends for access to the motors and reduction gear, etc., and the middle section for access to the resistance coils housed in an asbestos-lined cradle.

The windows in the sides and in the driver's cab were of $\frac{3}{16}$-in. Perspex, and the engine room ventilation louvres were made from a section of grilles from an old hot-air duct found among the scrap. Imitation brass horns were mounted on the cab ends, as in the prototype. The bodywork being completed, several undercoats of paint were applied, filling and rubbing down taking place between coats, until a dead smooth finish was obtained. A finishing coat of hard-gloss black enamel was then applied, followed by the single silver stripe running the length of the engine, and finally the "British Railways" crest and the "Reed Paper Group" emblem, topped by a coat of varnish.

I might add here that the generous co-operation and helpful advice of Mr. Day, the woodwork master, was very much appreciated by all, and helped in no small way to the undoubted success of the finished model.

The engine was then taken over by the members responsible for the electrical side of the model, under the supervision of Mr. F. W. Spencer, one of the firm's electrical engineers. Wiring of all the connections was carried out, including collector shoes, resistances, reverse switches, etc., and the motors were installed. Power was supplied by two continuously-rated, series-wound d.c. electric motors of one-third horse power at 24 volts, 1,600 r.p.m.

This brought us to the stage of the first test—but some more details before telling of this. Current is collected from the third rail (which serves as the $3\frac{1}{2}$-in. gauge track when running steam locomotives of that gauge) by means of spring-loaded brass plungers bearing on the rail. These plungers are housed in a plastic guide, which insulates them from the framework and is bolted directly to the bogie frames. There are two control levers situated beneath, but in line with narrow slots cut in the cab roof at one end of the locomotive. The purpose of this is to stop any unauthorised person or children from starting the locomotive whilst it is left unattended for any reason. To start, the driver merely pushes an extension lever through the slots in the roof and on to the control levers below, just in the same way as our "live steam" brothers do on their hand pumps. The first slot is marked OFF and FULL and is worked on the usual button contact resistance giving zero to full speed. The second slot is marked FORWARD-OFF-BACKWARD and consists of a plain double-throw switch with neutral position. Both motors are fed and controlled from the one set of levers.

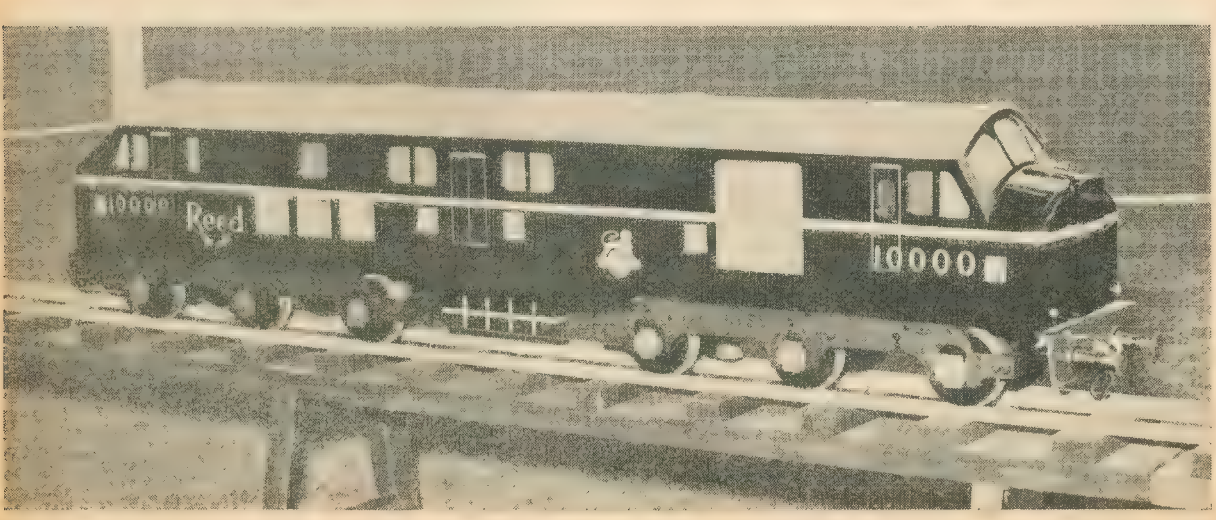
Electric power for the railway is obtained from the normal supply of 230 volts a.c. connected to a transformer-rectifier unit which supplies the third rail with current at 24 volts d.c. If necessary, or if so desired, two 12-volt car batteries may be used instead; they will give continuous running for about six hours.

Although motors are rated at 48 volts, 24 volts was found to give speed of 6-8 m.p.h.; it is hoped that, at some future period, voltage will be increased, with corresponding increase in m.p.h. up to a maximum of 14 m.p.h.

The engine can be driven in three different ways. The usual way, in which the driver sits on the front end of the first truck and leans over to the controls; or by sitting on the roof of the engine and using one of the lifting bars as foot-rests, or if necessary the engine can be remote-controlled from the switchboard which is attached to the rectifier, the latter, of course, having to be placed roughly half way along the 200-ft. straight track, so that the operator may control the train more efficiently. A variation of the last method is to have the control switch at the station, or leading end of the track, and a plastic tapered cam screwed to the sleepers at the other end of the track, about 6 ft. from the buffer stops. This tapered raised cam engages with a lever which is directly pivoted to the reverse switch. A similar raised cam at the station end of the truck pushes the lever back, but only to the OFF position. As mentioned earlier, the switch is marked positionally as FORWARD-OFF-BACKWARD.

Lifting of the locomotive is simple. A steel bar, $\frac{3}{4}$ in. diameter and 3 ft. long, is inserted under and through each buffer beam up to a stop-pin and locked in the middle position by pushing a partially opened split-pin

(*Continued on page* 402)



READERS' LETTERS

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

LATHE DESIGN

DEAR SIR,—I was most interested in the letter from Mr. Nicholls in your issue of February 10th on "Foot-lathe Power."

With reference to Mr. Nicholl's surmise that a lathe bed can "be twisted by mere foot-effort," he is undoubtedly right. Many years ago THE MODEL ENGINEER published a most interesting article by the late Hy. Lea, in which he described his investigations into this very matter. The lathe concerned was quite a substantial one, from memory, of about 5 in. centres, with a hefty bed. He found (*a*) that a very slight eccentricity of the leadscrew (which was supported at each end) was itself sufficient to cause the bed to distort in such a way that a periodic tool mark appeared at regular intervals on the surface of a shaft being turned between centres; and (*b*) that by bolting a flat bar on to the face of the lathe bed at the tailstock end, with an overhang of about 12 in. and hanging a 1 lb. weight at the outer end of the bar, a quite easily detectable twist was caused in the bed. Thus one can well imagine the sort of thing that occurs with a "dig in," more especially at high speed. Keeping slides properly adjusted is a great help towards avoiding these phenomena.

I would agree completely with Mr. Nicholl's remarks on mandrel sizes. In fairness to Messrs. Drummonds and to other makers of small lathes, I would

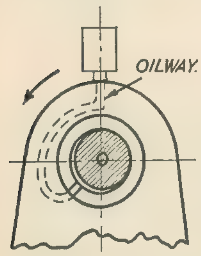


Diagram showing (exaggerated) position mandrel takes up under tool pressure. Area in vicinity of inlet for oil is area of minimum pressure

suggest that it is quite certain that they too knew all this. The question is one of economics: if one has a really hefty mandrel it must be mounted in adequate bearings, themselves carried in a really robust headstock, which in turn requires the bed to be up to its job, whilst this again requires a saddle and slide-rest strong enough to stand up to the stresses liable to be imposed upon it; all this, of course, involves added cost for both materials and labour, and can only be had at a price, a price generally well outside what the average amateur can afford, or is prepared to pay. Mr. Nicholl's point about thin oil is a very good one; I would add that the oil should be applied, not as it is usual, on top of the bearings, but in the position shown in the sketch. If applied on top, as soon as a cut is applied the tendency is to squeeze out the oil, whereas if fed in where shown, the revolving mandrel tends to drag in a film of oil and so, in effect, to make a "hydraulic bed" for itself to "float" upon. That, of course, is the underlying principle of the Michell thrust bearing, now in almost universal use for marine propeller shafts.

A really first-class lathe can never be cheap in the more immediate sense, but on the other hand, once bought, so long as it is reasonably treated and properly maintained, it will give a lifetime of good and trouble-free service, and will be a joy to possess and to operate.

Yours faithfully,

Rustington. K. N. HARRIS.

MINIATURE LOCOMOTIVE PERFORMANCE

DEAR SIR,—In your issue for March 3rd last, Mr. Austen-Walton stated that his "Twin Sisters" 0-6-0 tank engine, consumes an abnormally small amount of coal and water, also he is able to "toddle" around the Beech Hurst track for the *whole evening* on one filling of coal and water, by using the capacity of his extra tank and bunker on the driving truck.

My old friend, "L.B.S.C.," has also mentioned many times that he is able to drive his $2\frac{1}{2}$-in. and $3\frac{1}{2}$-in. gauge engines for a mile on one firing, which I do not doubt for a moment.

As a student of miniature locomotives, I do not think that these statements help very much. By what standard does Mr. Austen-Walton judge his *very low* consumption? By his own other engines, or by the engines owned by the members of his club?

In order to be able to compare the performances of Mr. Austen-Walton's and "L.B.S.C.'s", engines with those which we own and run, I think it would be most useful if he would give us the *data*, in terms of hours run, the amount of coal and water used, including lighting-up, the load carried, weight of trucks and the distance covered.

In order to start the ball, I have found that, with my 5-in. gauge 0-6-0, I use *about* 1 (one) lb. of coal to 10 lb. (1 gall.) of water an hour, hauling myself (12 stone) and a 28-lb. truck on my 100-ft. up-and-down track. I may add, that I saw Mr. Austen-Walton driving his "Twin Sister" on the Beech Hurst track, and was very impressed with its performance. I have also run my 5-in. 0-6-0 on the same track, but was not able to record the fuel and water consumption.

Another point is the track; you cannot compare "L.B.S.C.'s" track, which is almost level, with, say the one at Beech Hurst which has some fair grades whichever way you choose to run, and although a $3\frac{1}{2}$-in. or 5-in. gauge engine does not take much notice of a single passenger, it is a coat of an entirely different colour when you put up say four 11-stone adults, on two trucks. The engine herself will tell you the work she is doing! One very well-known engine which can easily haul three trucks with 8/9 adults, round a track like the one at the Malden Club, has a very difficult job to hold her feet hauling two trucks and four adults, up the grades at Beech Hurst. There is no doubt that the type of rails used is the principal cause of the slipping.

Then again, using a 100-ft. up-and-down track, you are bound to use more water, seeing that you must make about 50 starts and stops to a mile. And you probably use more coal, because when steam is off cylinder, you must have the blower constantly on to keep the fire alive. The metal used for the rails is, in my opinion, very important where there are grades on the track

My ideal track surface is slightly rusty steel; of course, the maintainance of steel rails, during winter, especially on large tracks is a matter of serious consideration, but my method is to scrape and wipe the rails, then paint them with aluminium paint, somewhere about the middle of November each year, and this keeps the rails in good condition until you start operations about Easter time the next year.

Hoping that these remarks may be of some interest.

Yours faithfully,

West Wickham. G. W. VICKERAGE.

FOREWARNED IS FOREARMED

DEAR SIR,—With the advent of graded tracks it would appear that the risks arising in the event of a locomotive breaking away from its train are considerably increased.

While such an occurrence is to be deplored, it does sometimes happen, a recent instance being caused by a coupling retaining-nut working loose and stripping the last threads, a situation that can arise unnoticed even by the best of drivers.

Might I suggest that a $3\frac{1}{2}$-in. gauge coupling hook have a shank rather more than $\frac{1}{8}$-in. square, sufficient to take a full 4-B.A. thread when turned. If not both ways the vertical plane

can very easily be left that size. That it be provided with a lock-nut and finally cross-pinned.

A little more effort, maybe, but much better than an unexpected heap of mixed scrap.

Yours faithfully,
Sedlescombe. J. B. HUGHES.

LEFT-HANDED LATHES

DEAR SIR,—Your comments in "Smoke Rings" in the February 3rd issue about the photograph of a "wrong handed" lathe, and that "there ain't no such animal" are correct ordinarily.

However, there *are* such lathes, but they are very special and of large size—about six feet swing and upwards in my experience—though others may have seen an odd smaller one.

It is sometimes convenient in the case of very long lathes to put a headstock on both ends so as to get more use out of what would otherwise be a little used tailend. In such cases there is more than one carriage (necessarily), and also a second tailstock which can be lifted off if the length of the work requires it, such as for example, a very long tail-shaft. It is also convenient for the tail end headstock to be of the opposite hand to the usual one in order to be operated from the same side of the bed. By this means two lathes are incorporated in one long bed.

There were two lathes like this at Vickers works at Barrow-in-Furness, where I worked as an engine fitter from 1915-19, and I would say they were all of 60 ft. long and had faceplates of about 6 ft. diameter. They also had four travelling saddles, each with tool rests front and rear. One was built by John Hetherington of Manchester, and the other by Hulse and Company also (I think) of Manchester. Cravens, of Manchester, also build these double ended lathes if required by a customer.

I have seen more than one photograph of a turner working at an apparently "wrong handed" lathe of ordinary size, but it was evident on a close look that the negative had been reversed in printing.

Yours faithfully,
British Columbia. WALTER TAYLOR.

CARBON CASE-HARDENING STEELS

DEAR SIR,—From time to time constructive articles appear in your excellent journal, in which the contributors—some of the regulars at that—specify the use of mild-steel for the production of certain components, ultimately to be case-hardened. According to a "Dictionary of Metallography" which I have in my possession, this case-hardening is a process of carburising low-carbon steel, followed by subsequent quenching, so as to produce an article which, by virtue of the high-carbon case, has a hard wearing exterior;but by virtue of the low-carbon core, is tough and ductile in the interior.

The two carbon case-hardening steels which seem to be fairly frequently in use are to British Standards EN32A and EN32B. These have carbon contents of 0.15 per cent. maximum and 0.10/0.18 per cent. respectively.

To the best of my knowledge commercial mild-steel may reasonably be expected to have carbon contents of between 0.08 per cent. and 0.25 per cent., this range is normally sub-divided into what is loosely known as five points of carbon, i.e. 0.08/0.13, 0.13/0.18, 0.15/0.20 per cent., etc., but one of the commonest mild-steels in everyday use is the 0.15/0.25 per cent. range. I am informed that mild-steel with a carbon content in excess of 0.20 per cent. does not case-harden satisfactorily, as it tends to harden throughout the job, thereby destroying the very purpose of the process, part of which is to give a ductile interior, which I presume could be expected to stand up to shock.

I should say that the chances of bright drawn mild-steel being within the carbon ranges mentioned in paragraph two, are fairly good, and semi-free cutting bright drawn or black steel would also qualify, but from my own experience commercial quality black mild-steel would be a doubtul proposition. Might I suggest that future contributors specify more exactly what they mean and avoid such terms as "mild-steel," "nickel-steel" etc., which can embrace a wide range of sins, unless such a state of affairs is of no consequence to either the job or the production of it.

Yours faithfully,
Churchill. "STEEL MERCHANT."

ELECTRIC CLOCKS

DEAR SIR,—In recent issues of THE MODEL ENGINEER there have been two enquiries from readers concerning details of the electric clock described in the little book I wrote for your firm some years ago. I think it should now be made clear that the arrangement described can no longer be considered, as the direct use of mains current produces a devastating effect on the television screen, not only in the house where the clock is working but also next door. To put matters right, my clocks have been reconstructed to use 4 V, a.c. in one case, using a bell transformer, and 6 V, d.c. in the other, this latter being produced by a similar transformer and selenium rectifier. I rewound both magnets using No. 26 enamelled wire with about 350 turns on each leg.

I have no television myself, but my neighbour is an expert, and he was much puzzled for a long time by the extraordinary effects on his screen. He soon ran down the source of the trouble and the cure was quickly forthcoming.

Yours faithfully,
Welwyn. R. BARNARD WAY.

TELEVISION AND RADIO SUPPRESSION

DEAR SIR,—I have read a reply to a query on television suppression, in The MODEL ENGINEER dated February 10th, which prompts me to write to you on the subject.

It is a part of my job to design television and radio interference suppression for all types of electrical apparatus and from my experience I think that it is very unlikely that capacitors of 0.01μF. would suppress interference at TV frequencies. This is because a capacitor of that capacitance would have a high impedance due to its inductance. Although for lower frequencies it would appear to be non-inductive. Mica capacitors of between 0.001μF and 0.0005μF would be more suitable at these frequencies. However capacitors are only effective in very mild cases. As a general rule, for TV suppression, miniature dust-iron cored chokes are very effective, more reliable and cheaper. In most cases one in each brush lead inside the motor will cure the trouble. In severe cases, an additional one in each mains lead where it leaves the motor will suppress these.

The suppressors for TV and radio interference are different and it is very unusual to find one suppressor to cope with both.

I would suggest that if anyone wants any advice on suppression they should write to the Post Office Radio Service at the address of the local telephone manager, asking for an engineer to call and give advice on any suppression that may be needed. This service is free. At the present time this service will carry out the suppression at a small charge.

I am hoping this information may be of use.

Yours faithfully
Paignton. G. A. SRODZINSKI.

Next Week . . .

FLASH STEAM
Concluding the description of experiments in plant design by J. A. Bamford.

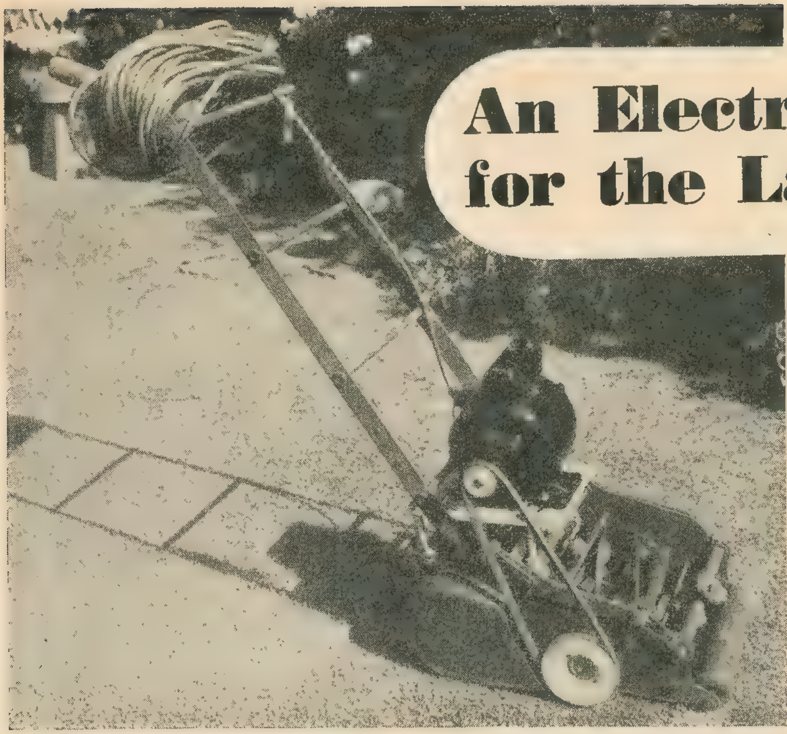
A MODEL ROWING BOAT
An interesting and ingenious model, complete with oarsman, and driven by a miniature electric motor.

PARTING TOOLS
'Duplex' describes a special parting toolholder for use in the rear toolpost.

CIRCULAR DIES
How to make efficient "button" dies in the home workshop

"NETTA"
The boiler for the 3½-in. gauge engine is the next item to be dealt with.

REBUILDING A STEAM TRACTOR
An entertaining account of how a steam tractor that had once been a steamroller was purchased, thoroughly renovated and put into first-class condition for use.



An Electric Drive for the Lawn-Mower

By L. F. Short

FOR quite a long time I have toyed with the idea of motorising my lawn-mower with a view to easing the labour and reducing the time when cutting the lawns, thus giving me more leisure to devote to the pursuit of our hobby.

I had hesitated to go for an electric drive because I thought the trailing cable would be a nuisance, but in the end I decided to try it.

My machine is of the roller type, the cutter cylinder being driven by chain, and on examination I found that a pulley of the form shown in the sketch could be accommodated quite easily on the cutter driver spindle under the bearing nut.

The largest diameter possible for this pulley was approximately 4 in., and in order to run the cylinder at the normal speed, which I calculated to be between 500 and 600 r.p.m., the motor pulley had to be about 1¾ in. dia. for a motor running at 1,425 r.p.m.

A standard industrial V belt, Symbol A31, was used and a ¼ h.p., 240 volt, S.P. motor was purchased at a very reasonable figure from one of the "M.E." advertisers.

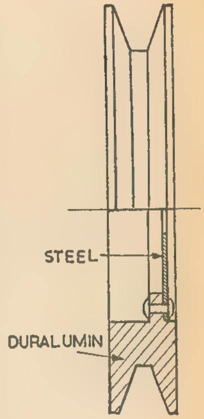
Mounting

To mount the motor on the machine, a duralumin platform about ⅛ in. thick was used, set on four ½ in. dia. duralumin columns screwed and fitted with nuts above and below holes in the platform to allow of height adjustment for belt-tightening.

The lower ends of these columns are screwed into ordinary malleable iron pipe clips to fit the cross bars separating the steel plate sides of the machine.

It will be realised that the motor drives the cutter cylinder only, the chain having been removed; nevertheless, I consider it to be well worth while, because the effort required to push the machine is very small, and I do not find the trailing cable to be a serious handicap.

The pulleys were turned from scrap on a 3½-in. lathe.



A 5-in. GAUGE ELECTRIC LOCO

(*Continued from page* 399)

through a hole drilled in the bar. All the buffers are spring loaded, as are also the coupling draw hooks.

Now to return to the first test. Everything worked, but under load a certain amount of slipping took place, so a 1-cwt. block of lead was cast and placed under the resistance panel in the centre section of the chassis. (It is hoped at a later date to make all axles driving, by fitting chains and sprockets, owing to the fact that with a load of 12 children and over, slipping was apt to take place in spite of the lead weight.) A period of adjusting and experimenting took place and the locomotive was completed just in time to make its maiden run at Cobdown Show, 1954, the Reed Paper Group's Annual Show, held on the last Saturday in August. The show is a combined event and includes sections for horticulture, art and crafts, fur and feather, as well as model engineering.

On the afternoon of the show, promptly at 3 o'clock the engine made its inaugural run and was driven by the model engineering society's chairman, Mr. H. H. Watson.

It ran perfectly all afternoon, and must have travelled nearly 20 miles and given rides to about 2,000 children. This, in itself, is a tribute to the members who designed the gearing and transmission.

In conclusion, thanks are due to those members who worked so hard and willingly and gave up so much of their time to the designing and building of this magnificent and highly successful locomotive. In addition, all concerned appreciated the interest and kindly co-operation shown by the chairman, Mr. H. H. Watson, and the chief electrical engineer, Mr. C. Severs, who were initially responsible for the "10000" going into production.

WITH THE CLUBS

Huddersfield Society of Model Engineers
The society has had a full programme of meetings during the winter session, and various speakers have provided some very interesting evenings. The efforts of the officials and committee towards the success of the session have been worthy of better attendances than we have had at some meetings.
On April 20th we are hoping to have a visit from Mr. W. J. Hughes.
A "Bits and Pieces" sale is being arranged for May 12th and the A.G.M. is to be held on May 26th. All meetings commence at 7.30 p.m.
We are to have our first Open Day of the summer session on Saturday, April 30th. Visitors from other clubs and lone hands are welcome.
Hon. Secretary: H. DEACON, 291, Blackmoorfoot Road, Crosland Moor, Huddersfield.

Edinburgh S.M.E.
About thirty-five members and friends spent an enjoyable "Club Night" at 54, Queen Street, on March 8th, thus proving that the new venture is an undoubted success.
Our next meeting will be held at 7.30 p.m. on April 12th in the club rooms, when Mr. S. Blyth will give a demonstration of bronze welding and brazing. Mr. Blyth is a highly experienced craftsman who has just finished the brazing of the club's locomotive boiler, which will be on view.
The workshops and clubrooms at 1A, Ramsay Lane, Lawnmarket, Edinburgh, are open on Tuesday evenings from 7.30 p.m. and Saturday afternoons from 3.0 p.m., and all interested are welcome.
Hon. Secretary: J. H. FARR, Wardie Garage, Ferry Road West, Edinburgh, 5.

Hastings & District M.E.S.
On March 13th, a party of members spent a pleasant afternoon visiting the Ashford Locomotive Works; much was seen in the few hours at our disposal and all members became aware of the rigid schedule to which locomotive repairs are subjected.
The April meeting, on Tuesday 19th, will be devoted to Mr. R. A. H. Weight's annual talk which will be illustrated by many photographs from his vast collection, and on May 17th members have been invited to the home of Mr. C. B. Reeve for an informal talk on his recent clocks.
The society's exhibition has been arranged for August 7th-12th in the White Rock Pavilion. G. Priestley, of Moreton House, Boscobel Road St. Leonards-on-Sea, has the unenviable task of Exhibition Secretary this year. Competitive sections are being arranged and he would be glad to hear from model engineers who would care to exhibit at the show.
Hon. Secretary: W. BROGAN, 4, Mount Pleasant Road, Hastings, Sussex.

Norwich & District S.M.E.
At the meeting of the above society, to be held at The Assembly House, Theatre Street, Norwich, on April 13th, 1955 at 7.30 p.m., a talk on *Britannia* in $3\frac{1}{2}$" gauge will be given by Mr. G. R. Cross. All old and new members will be most welcome.
Hon. Secretary: A. A. TAYLOR, 150, Furze Road, Thorpe, Norwich.

The Junior Institution of Engineers
Friday, April 15th at 7.0 p.m. Pepys House, 14, Rochester Row, S.W.1. Ordinary meeting. Paper: "The Design of, Materials Used In and the Manufacture of Pick Steels for Pneumatic Picks," by C. Hutchinson (Associate Member and Durham Bursar).
Sheffield and District Section. Monday, April 18th at 7.30 p.m. at Livesey Clegg House (opposite Union Street Cinema), Sheffield. Ordinary meeting. Paper: "The Organisation of an Engineering Company," by F. Sargeant, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E. (Senior Partner: Urwick, Orr & Partners Ltd.).
Friday, April 22nd at 7.0 p.m. Pepys House, 14, Rochester Row, S.W.1. Informal meeting. Paper: "Some Preliminary Notes on the 'Electronic Brain' in the Automatic Factory," by W. J. Kease (Member and Durham Bursar).

Crewe Model Engineering Society
This society will be holding an exhibition in The Corn Exchange, Crewe on Friday and Saturday May 6th and 7th, and extend to all enthusiasts in the district, a warm invitation to visit them.
Hon. Secretary: J. V. GILLAM, 161, Remer Street, Crewe.

The Brighouse S.M.E.E.
At our meeting held in the headquarters, Ravensprings Park, on March 8th, members and guests were entertained with a film show, the films being "Dodging the Column," "Scottish Express," "Ocean Terminal" and "Journey to the Sea," all on loan from British Railways. These were followed by our own copy of the film taken for the TV of our activities. This film, unfortunately, broke down.
Nine new members were admitted, making a membership of 157.
Work is now going ahead by a few members in overhauling our president's $7\frac{1}{4}$ in. gauge Pacific, "Duchess of Brighouse," which will be travelling to The Model Railway Exhibition, Central Hall, Westminster, during Easter—not, of course, under its own steam.
Our programme for the coming season is now being arranged.
Hon. Secretary: G. HARRISON, 98, Park View, Rastrick Common, Rastrick, Brighouse.

The West Riding Small Locomotive Society
We are organising a two-day rally of model locomotive enthusiasts, to be held on Saturday, June 25th, 10.0 a.m., to Sunday, June 26th, 10.0 p.m.
This year we are making special efforts to attract clubs, societies and individuals from a large radius, and we extend a cordial invitation to all.
It is our intention to give visitors unrestricted use of the multi-gauge track of $2\frac{1}{2}$ in., $3\frac{1}{2}$ in., $4\frac{11}{16}$ in., 5 in., and $7\frac{1}{4}$ in. gauges, for the maximum time possible, dependent, of course, on the number of locomotives which are brought.
To make this rally slightly competitive, awards will be made for the most outstanding locomotive in appearance and performance and the runner-up in this class. An award will also be made to the locomotive brought the greatest distance.
Arrangements are being made to accommodate caravans and tents if this is required. Modern toilet facilities are available (ladies and gents). Fuel, oil, bogies, batteries for blowers, and light refreshments will be available throughout the rally. Models will be on display in a marquee.
Any detailed particulars of facilities available, or any other information, will be gladly supplied.
Tickets are in course of preparation and any number will be supplied on request.
The success of this rally depends on the number of visitors and we hope that many will support us by attending.
Hon. Secretary: F. W. SPENCER, 179, Raikes Lane, Birstall, near Leeds.

The Coventry Model Engineering Society
The model railway section is making satisfactory progress and is working on "OO," "O" and "1" gauge layouts which they are striving to complete for the club's 21st anniversary exhibition at the Sibree Hall in September 21st-24th.
All layouts are continuous and will have full scenic effects, and cater for steam, electricity and clockwork motive power.
A warm welcome awaits all railway modellers in Coventry and district if they will join us in this venture. Meetings are held every Thursday at 8.0 p.m. at the Centre Ballroom, Holyhead Road, Coventry. Visits to local places of interest to model engineers is also being arranged in the summer months.
The club as a whole meets at the above address on alternate Friday evenings.
Hon. Secretary: L. J. N. SOUTHAM, 52, Sussex Road, Coventry.

THE MODEL ENGINEER DIARY

April 9th and 11th.—Bletchley & District Model and Experimental Society.—Exhibition of working and static models at the Bletchley Secondary Modern School, Bletchley Road, Bletchley, Bucks. Open from 10.30 a.m. to 9.0 p.m. each day.

April 12th, 13th, 14th, 15th and 16th.—The Model Railway Club Exhibition, at the Central Hall, Westminster, London, S.W.1. Open from 12 noon to 9.0 p.m. on April 12th and from 10.30 a.m. to 9.0 p.m. on succeeding days.

April 16th, 18th, 19th, 20th, 21st, 22nd and 23rd.—Stockport and District Society of Model Engineers.—Exhibition of models at the Lads' Club, Wellington Street, Stockport. Open on Saturdays 10.0 a.m. to 9.0 p.m. Monday to Friday 6.0 p.m. to 9.0 p.m.

May 6th and 7th.—Crewe Model Engineering Society.—Exhibition of models in The Corn Exchange, Crewe.

May 22nd.—Forest Gate Model Power Boat and Engineering Society Regatta at Victoria Park, Hackney, London, E.9. Starting at 11.0 a.m.

May 28th.—Welling & District Model Engineering Society Regatta at the Belvedere Recreation Ground. Starting at 2.30 p.m.

May 30th.—Bournville M.Y. & P.B.C.—Regatta at the Valley Pool, Bournville Lane, Birmingham. Starting at 11.30 a.m.

June 11th and 12th. — Birmingham Society of Model Engineers.—Annual National Rally of Steam Locomotives at the track at Campbell Green, 87, Horse Shoes Lane, Sheldon, Birmingham.

June 25th and 26th.—The West Riding Small Locomotive Society.—Rally of Model Locomotives, Gauges $2\frac{1}{2}$ in. to $7\frac{1}{4}$ in., at Blackgates House, Bradford House, Tingley, Wakefield. Open from 10 a.m. to 10 p.m., both days.

August 17th, 18th, 19th, 20th, 22nd, 24th, 25th, 26th and 27th.—The Model Engineer Exhibition, in the New Horticultural Hall, Greycoat Street, Westminster, S.W.1. Open from 11 a.m. to 9.0 p.m.

CORRESPONDENCE
The Managing Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Correspondence and manuscripts should not be addressed to individuals, but to the Managing Editor, THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

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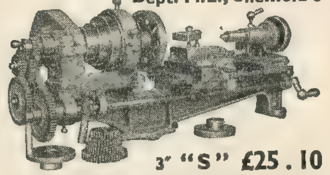

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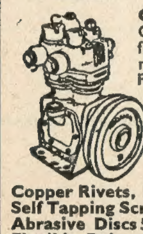

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